

ABSTRACT:

Objective—Sacroiliitis is a hallmark of the spondyloarthropathies (SpA). The degree of inflammation can be quantified by magnetic resonance imaging (MRI). The aim of this study was to further elucidate the pathogenesis of SpA by quantitative cellular analysis of immunostained sacroiliac biopsy specimens and to compare these findings with the degree of enhancement in the sacroiliac joints (SJ) as detected by dynamic MRI.

Methods—The degree of acute sacroiliitis detected by MRI after intravenous administration of gadolinium-DTPA was quantitatively assessed by calculating the enhancement observed in the SJ and chronic changes were graded in 35 patients with ankylosing spondylitis (n=19), undifferentiated SpA (n=12) and psoriatic arthritis (n=4). Back pain was graded on a visual analogue scale (VAS, 0–10) and disease duration (DD) was assessed. Shortly after MRI, SIJ of patients with VAS > 5 were biopsied guided by computed tomography. Immunohistological examination was performed using the APAAP technique; only whole sections > 3 mm² were counted.

Results—By MRI, chronic changes <

grade II were detected in sixteen patients (group I, DD 2.9 (SD 2.5) years) and > II in 14 patients (group II, DD 6.5 (SD 4.3) years), while enhancement < 70% was found in sixteen (group A, DD 6.8 (SD 3.3) years) and > 70% in fourteen patients (group B, DD 2.8 (SD 5.3) years). The relative percentage of cartilage, bone and proliferating connective tissue was comparable between the groups. There were more inflammatory cells in Group 1 (16.8 (SD-4.7) than in Group 2 (8.25 (SD-2.3) and in Grade B (18.14 (SD-3.4) than in Grade A (8.63 (SD-1.9), T cells being slightly more frequent than macrophages.

Conclusion—This study shows that T cells and macrophages are the most frequent cells in early and active sacroiliitis in SpA. The correlation of cellularity and MRI enhancement provides further evidence for the role of dynamic MRI to detect early sacroiliitis.

Key words:Dynamic MRI,Spondyloarthropathies,Sacroilitis,Inflammatory cells

COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY DIAGNOSIS OF SACROILITIS IN SPONDYLOARTHROPATHIES

INTRODUCTION:

Spondyloarthropathies refers to a group of connective tissue disorders having similar characteristics with involvement of axial and peripheral joints. Sacroilitis is an important manifestation, which is centrally involved joint in ankylosing spondylitis and other seronegative spondyloarthropathies.(1)

Sacroiliac joints are one of the earliest joints to be involved and sacroilitis is one of the important feature for diagnosing these spondyloarthropathies .Although Xray remains the initial method for evaluation of these disorders, early diagnosis of this disease remains difficult.(2,3)

Biopsy is needed to confirm the presence of early sacroilitis in spondyloarthropathy cases. Sacroiliac joint biopsy is not a versatile procedure to be carried out in every case of spondyloarthropathy as the sacroiliac joints are deeply located and the joint is not amenable for biopsy.(4).

Magnetic resonance imaging is being evaluated in early diagnosis of sacroilitis. Magnetic resonance imaging using dynamic examination helps to tell the activity and chronicity of the inflammatory changes taking place in sacroiliac joint. Magnetic resonance imaging can quantitatively assess the degree of inflammation.(5-8).

The number of studies on biopsy and histology of sacroiliac joint inflammation in spondyloarthropathies is limited for decades.(9) There are only a few studies on sacroiliac joint in Indian Population.

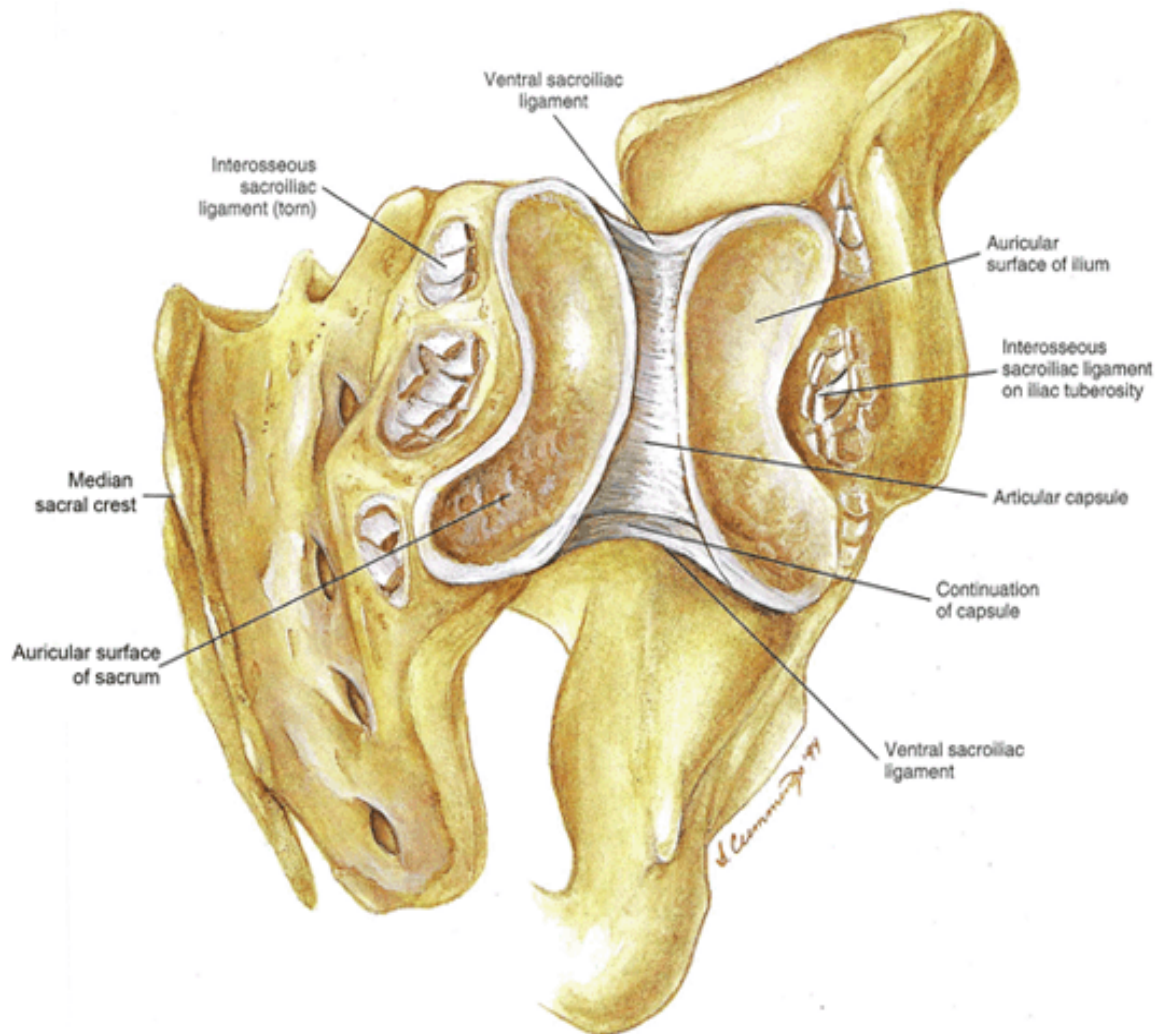
The purpose of this study is to delineate the role of 'Dynamic Magnetic Resonance Imaging' in early diagnosis of sacroilitis thereby reducing, the necessity of sacroiliac joint biopsies and also to elucidate the pathogenesis of spondyloarthropathies and quantitatively analyse the immunostained sacroiliac specimens obtained by computed tomography guided biopsy and to compare the degree of enhancement seen in the sacroiliac joints using dynamic MRI with the histological findings.

Articular injection of steroids with the help of Computed Tomography in sacroiliac joint provides a promising effect in pain management of sacroilitis , which also validates the role of interventional radiology in this disorders.(10,11)

REVIEW OF LITERATURE

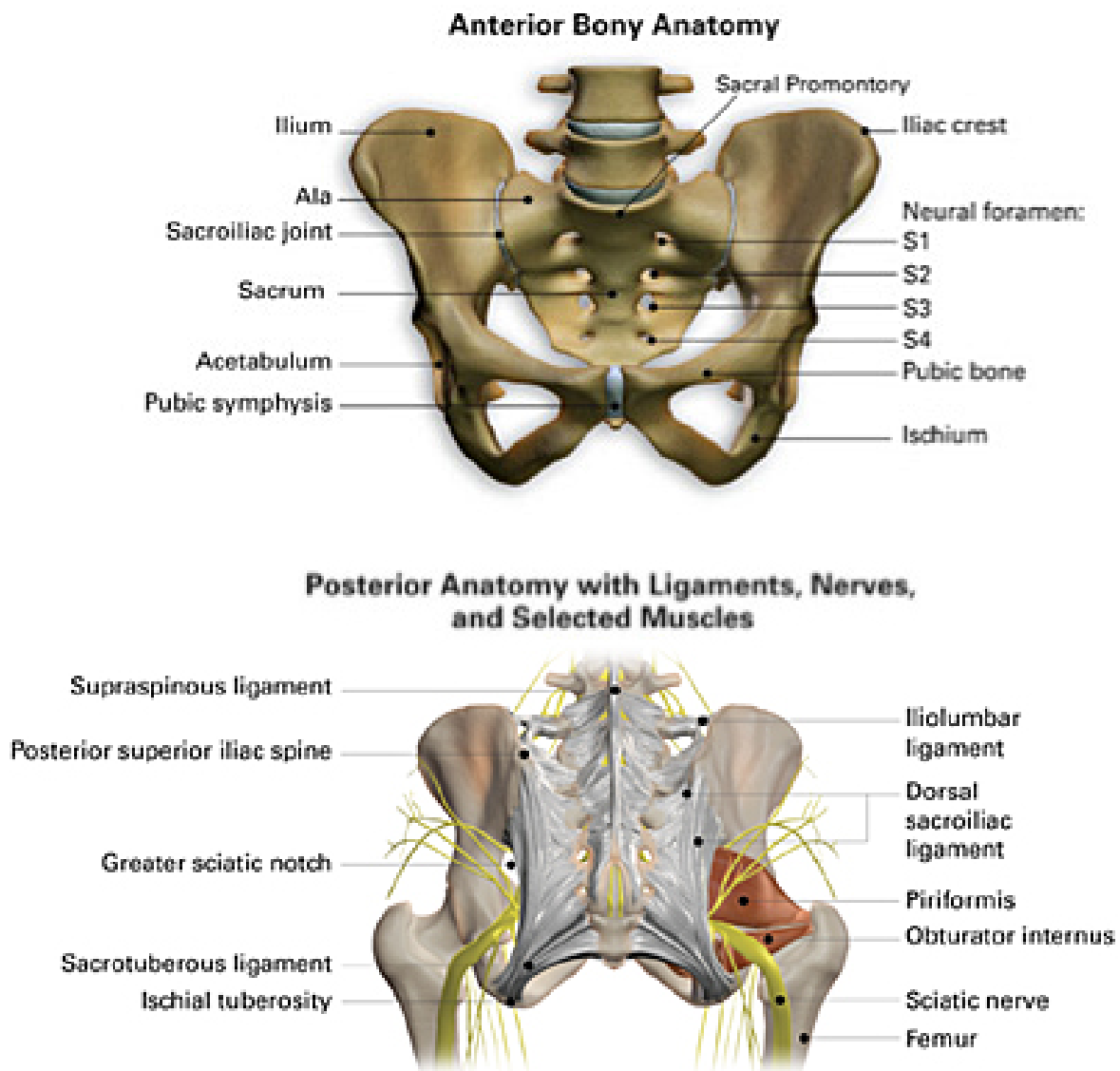
ANATOMY OF SACROILIAC JOINT:

Sacroiliac joint is a type of synovial joint. It's a true diarthrodial joint, that is it allows the bones to glide past one another in any direction along their plane of intersection. The articular surfaces are flat in infants, but in adults varying degrees of interlocking irregularities are seen causing restricted movements at this joint.



ARTICULAR SURFACE:

Articulations of sacrum and iliac bones forms the sacroiliac joint. Fibrocartilage covers the articular surface of sacrum and hyaline cartilage covers the articular surface of ilium.(12). Sacroiliac joint is characterised by unique features, that is not found in other diarthrodial joints(13)



LIGAMENTS:

The **Fibrous capsule** is firmly attached to the margins of the articular surfaces and is lined by synovial membrane.(12)

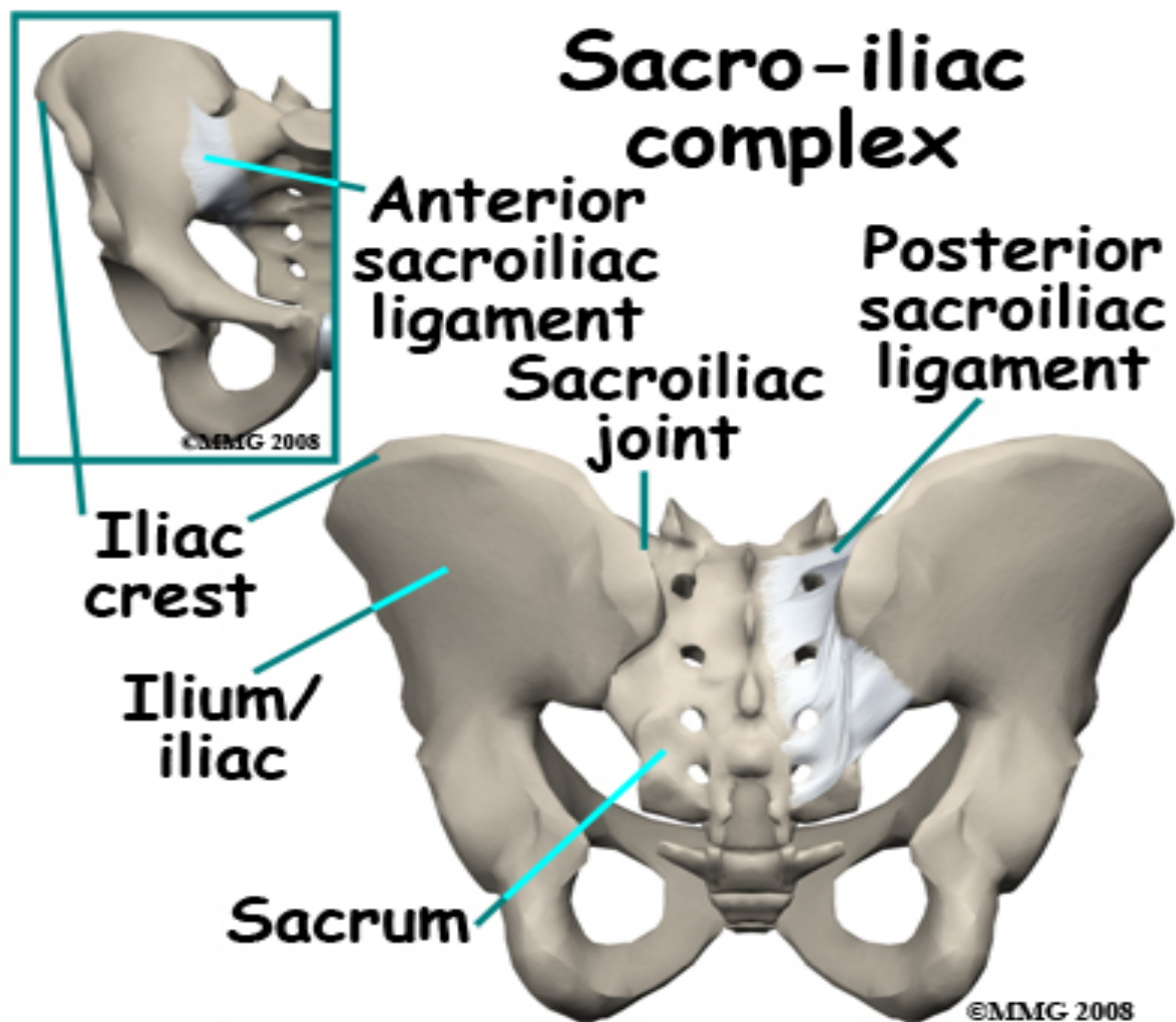
The **anterior or ventral sacroiliac ligament** is thickening of the anteroinferior part of the fibrous capsule.(12)

The **interosseous ligament** is one of the main ligament of sacroiliac joint. Sacrum and ilium are connected by this ligament. It is a strong ligament connecting the rough areas, adjacent to the rough margins of the articular surfaces. Posterior sacroiliac ligament covers this ligament.(12)

The **dorsal or posterior sacroiliac ligament** is another ligament of sacroiliac joint covering the interosseous ligament. The dorsal rami of sacral spinal nerves and vessels separates this two ligaments. This ligament consists of two parts

(1) transverse fibres, which is short and posterior extending from the transverse tubercles of the first two sacral vertebrae to the ilium and

(2) vertical fibres which is long and band like, seen extending from the transverse tubercles of third and fourth sacral vertebrae to the posterior superior iliac spine. This ligament is seen to continue as medial edge of sacrotuberous ligament, laterally.(12)



The vertebropelvic ligaments includes

- a) iliolumbar
- b) sacrotuberous
- c) sacrospinous

These are accessory ligaments of the sacroiliac joint necessary for maintaining the stability of the joint.(12)

Iliolumbar ligament:

Iliolumbar ligament extends from the inner margins of the iliac crest to the transverse process of L5 vertebra. It is triangular in shape and is a strong ligament. It gives origin to the quadratus lumborum and is continuous with the anteromedial layers of thoracolumbar fascia.(12)

The psoas muscle covers the ligament anteriorly and erector spinae muscle covers posteriorly. It protects the spine by preventing antero-inferior displacement of the fifth lumbar vertebra and also prevents the forward motion at the sacroiliac joint.(12)

Sacrospinous ligament:

It is also a strong and long ligament forming the boundaries of the pelvic outlet and sciatic foramina. This ligament has two ends – superomedial and inferolateral end. The superomedial end is wide and is attached to the posterosuperior and posteroinferior iliac spines, upper part of the coccyx, lateral margin of lower part of the sacrum and transverse tubercles of lower sacral vertebrae. The inferolateral end appears narrow and medial surface of ischial tuberosity gives attachment to it. A

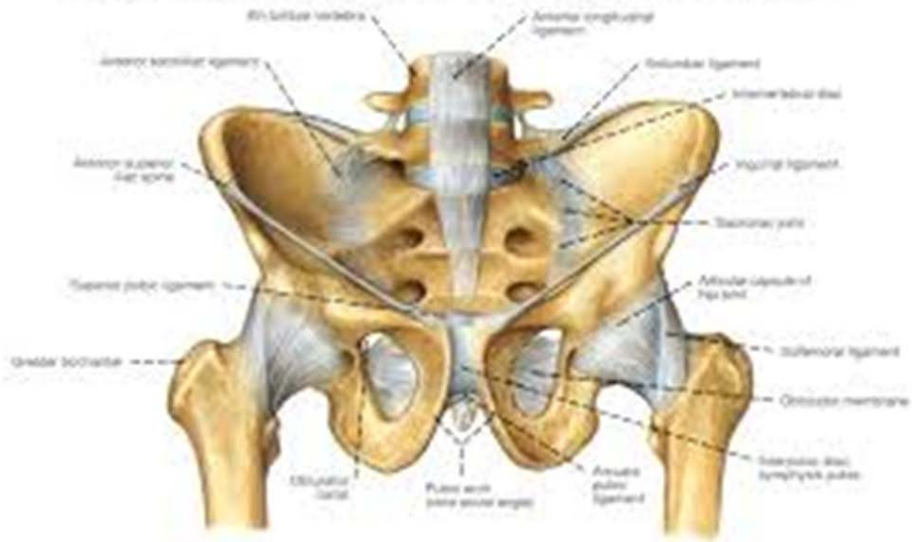
small part of the ligament extend along the ramus of the ischium and is called falciform process. The gluteus maximus partially takes origin from this ligament.(12)

Sacrospinous ligament:

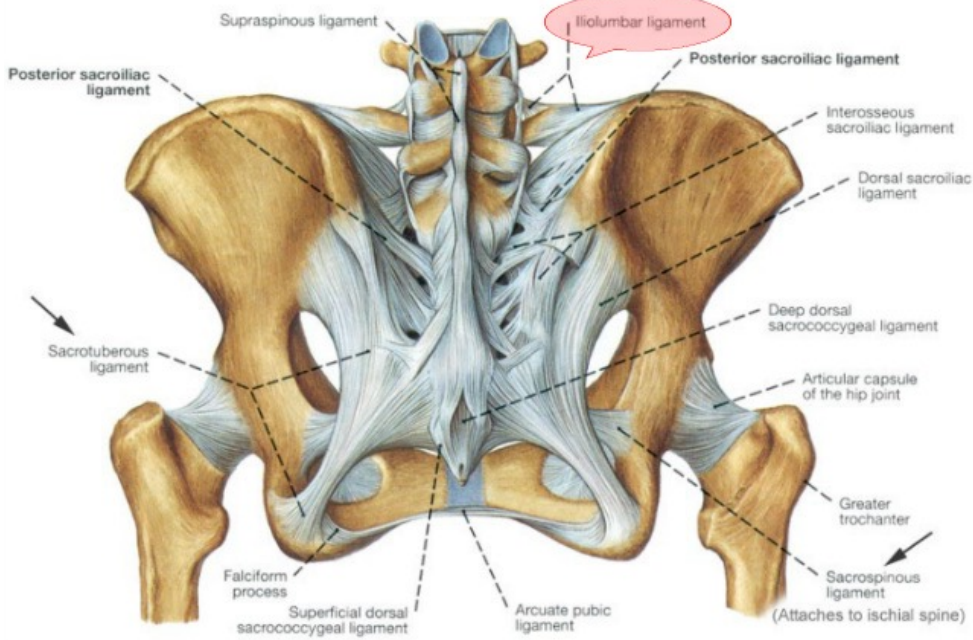
This ligament represents the degenerated part of coccygeus muscle, morphologically. This ligament lies deep to the sacrotuberous ligament and appears triangular in shape. It separates the greater and lesser sciatic foramina. It has apex, base and pelvic surface. Apex is seen attached to the ischial spine. The lateral margins of the fifth sacral and coccyx vertebra give attachment to the base. Coccygeus muscle takes origin from the pelvic surface of this ligament.(12)

This two ligaments strongly bind the ischium to the sacrum, thereby preventing the upward displacement of lower end of sacrum and downward displacement of upper end of the sacrum.(12)

Pelvis and Ligaments, Front View, Male



Pelvis and Ligaments, Rear View, Female



INNERVATION OF SACROILIAC JOINT:

The information available regarding the innervation of the sacroiliac joint is limited. It is not mentioned in Gray's Anatomy. (14 – 16)

Solonen collected the data from earlier studies which says sacroiliac joint is supplied by the branches of lumbosacral plexus the superior gluteal nerve, dorsal ramus of first two sacral nerves and obturator nerve. (17)

Cunningham's textbook of anatomy says small twigs from the sacral plexus and dorsal rami of S1 and S2 nerves and branches of superior gluteal and obturator nerves supplies the sacroiliac joint. (18)

Nagakawa et al, says that the nerve supply to the joint comes from the superior gluteal nerve, dorsal ramus of fifth lumbar nerve, ventral ramus of fourth and fifth lumbar nerves and, first and second sacral nerves. (19)

Ikeda et al concluded that the fifth lumbar nerve innervates the superior ventral part of the joint. The ventral rami of second sacral nerve or branches from the ventral ramus of sacral plexus innervates the inferior ventral part of the joint. The dorsal ramus of fifth lumbar nerve innervates the superior dorsal part and the dorsal ramus of sacral nerves supplies the inferior dorsal part of the joint. (20)

Another study by Grob et al says that the sacroiliac joint is entirely supplied by dorsal ramus of sacral nerves. In this study the innervation of sacroiliac joint by dorsal rami is confirmed by dissection of female pelvises and the neurofilaments were noted only in the dorsal mesenchyme.(21)

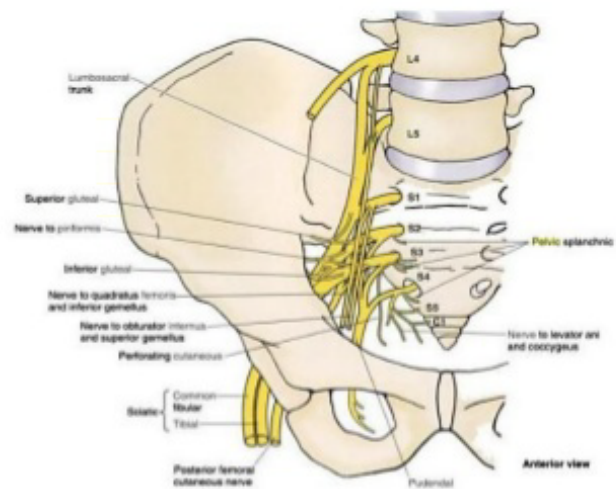
Another study by Fortin et al, states that the areas of hypoesthesia is noted only in the region of the dorsal ramus of sacral nerves after intra-articular anaesthetic injection.(16,22)

The presence of nerve filaments, within the joint capsule and adjoining ligaments, was verified by histological analysis. Microscopic examination of the samples obtained from the capsular ligamentous tissue of the ventral sacroiliac joint showed that it contains both nerve fascicles and axons.(16,23). The nerve fascicle is seen to contain both unmyelinated and myelinated nerve fibres, one non-paciniform mechanoreceptor and paciniform corpuscle.(16) This study suggests that the sacroiliac joint transmits both pain and proprioception impulses.(22)

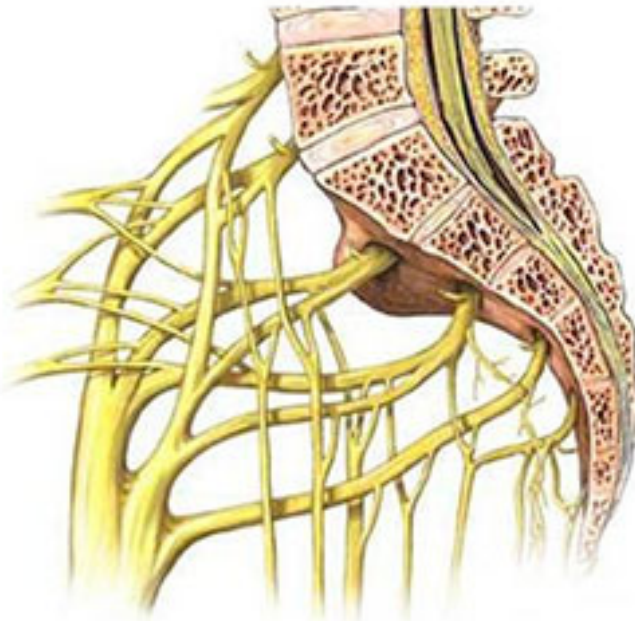
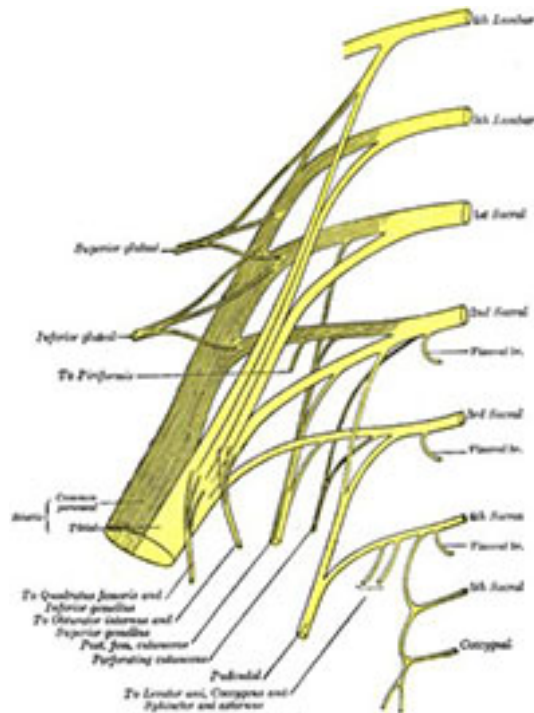
Communication noted existing between the sacroiliac joint and nearby neural structures. On post-arthrography CT, extracapsular extravasation of contrast from the sacroiliac joint is noted in to the dorsal sacral foramina, in to the fifth lumbar nerve sheath and also in to the lumbosacral plexus.(24,22)

Innervation

- Controversial and variable
- Murata et al in 2001:
 - Dorsal innervation: from the dorsal root ganglions of the lower lumbar and sacral levels (L4 to S2)
 - Ventral innervation originates from the dorsal root ganglions of the upper lumbar, lower lumbar, and sacral levels (L1 to S2)
 - Free end nerve fibers and mechanoreceptors in the SI ligaments and joint



(25)



BIOMECHANICS:

Various studies on sacroiliac joint movement has concentrated mainly on the degree and axes of the movement and found that the following movements occurs at the sacroiliac joint: gliding,rotation,tilting and translation.(26)Even though the precise nature of this movements are not clear,sacroiliac joint function may be affected by dynamic motion of lumbar spine,hip and pubic symphysis.(26)

The sacrum bone is wedge shaped in both dimensions and this configuration prevents the displacement of sacroiliac joint along with other ligaments.(27)

The small ridges and depressions which is seen on the articular surfaces also contributes to the joint stability.These ridges are said to occur in response to stress and vary from person to person.(28)

The differences between the male and female sacroiliac joint often exists and are attributed to the major forces used by males.Inmales,sacroiliac joint adapts to cope up the major forces.This along with thickening of the ligaments results in decreased mobility.In females,the hormonal influences on the joint increase the ligament laxity resulting in hypermobile sacroiliac joint.(29)

Axial compression failure is the most common mechanism that results in sacroiliac joint dysfunction. Compared to the lumbar motion segments, they are more susceptible to axial overloading. Any imbalanced loads may overcome the interlocking mechanisms of sacral vertebra by causing transiliac bony fixation and tension across the keystone. (29,30)

Miller et al, noted that a increased rotation of the sacrum noted in loading with one ilium fixed than in loading with both ilium fixed. (31)

Because of the poor wedging and poor locking of the articular surfaces in the anterior and posterior segments of the sacroiliac joint, the sacrum is forced to rotate under the influence of body weight. In this rotation the anterior segment is tilted downwards and the posterior segment upward. The downward tilt of the anterior segment is prevented by dorsal and interosseous sacroiliac ligaments and the upward tilt of the posterior segment is prevented by sacrospinous and sacrotuberous ligaments. (12)

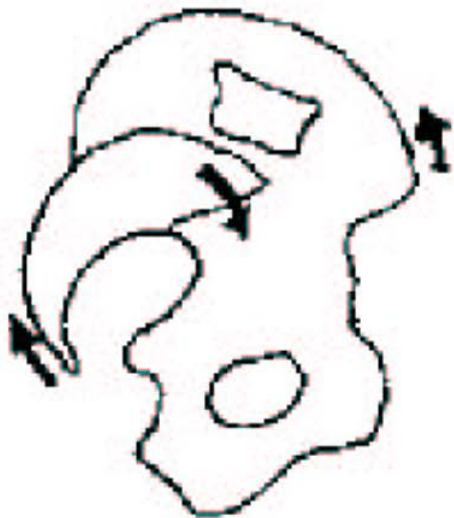
The sacroiliac and iliolumbar ligaments provide a reasonable support during all these movements, thereby resisting the separation of the iliac bones. (120)

KINEMATICS:

Sacroiliac joints are immobile joints. However, many studies have demonstrated a screw axis motion of sagittal plane, translation and rotation(32 – 35). The movements taking place at sacroiliac joints are referred to by nutation and counter nutation.(13,36)

Nutation is sacral base movement anteroinferiorly in relation to the ilium and counter nutation is sacral base movement posterosuperiorly(13,36). These movements occur along with flexion and extension of the lumbosacral joints respectively.(13)

A. NUTATION



B. COUNTERNUTATION



A. Nutation denotes sacral base movement anteroinferior in relation to the ilium.

B. Counternutation represents sacral base movement posterosuperior in relation to the ilium.

SPONDYLOARTHROPATHIES:

Spondyloarthropathies also known as spondyloarthritis, refers to a group of connective tissue disorders having similar characteristics with involvement of axial and peripheral joints.(37)

- 1) Reactive arthritis
- 2) Psoriatic arthritis
- 3) Ankylosing spondylitis
- 4) Arthritis associated with inflammatory arthritis/enteropathic arthritis
- 5) Undifferentiated spondyloarthropathy
- 6) Juvenile idiopathic arthritis
- 7) Isolated acute anterior uveitis

Spondyloarthropathy can also be differentiated into axial and peripheral Spondyloarthropathy depending upon the predominant regions of involvement. Axial Spondylopathy includes both Ankylosing Spondylitis and non-radiographic axial Spondyloarthropathy, based upon the presence or absence of abnormalities on plain radiography.(38)These diseases have the following conditions in common

- 1) Seronegative (i.e. absent rheumatoid factor)(39)
- 2) Inflammatory back pain(39)
- 3) Axial joint involvement preferably, sacroiliitis and spondylitis.(39)
- 4) Associated with *HLA-B27* positivity(39)
- 5) Inflammation of the place where the ligament or tendon gets attached to the bone, known as enthesitis(39)
- 6) Asymmetrical Oligoarthritis(39)
- 7) Presence of extra-articular manifestations like uveitis, urethritis, and aortic regurgitation(39)
- 8) Occurrence in families. (39)

SUBSET OF SPONDYLOARTHROPATHIES:

ANKYLOSING SPONDYLITIS:

Ankylosing spondylitis is the commonest seronegative spondyloarthropathy and is 2 to 3 times more common in males. Patients present with back ache at a very young age, but can also present with various symptoms like

peripheral arthritis and enthesopathy. Late onset of the disease is not common in ankylosing spondylitis, but in some patients may have late onset. (40)

Extra-articular manifestations of AS can include the following:

(41)

- 1) Uveitis
- 2) Cardiovascular disease
- 3) Pulmonary disease
- 4) Renal disease
- 5) Neurologic disease
- 6) Gastrointestinal (GI) disease
- 7) Metabolic bone disease

Inflammatory back pain is not specific to ankylosing spondylitis, but with history of uveitis, impaired chest expansion and a strong positive family history helps to diagnose ankylosing spondylitis. (41)

REACTIVE ARTHRITIS:

Reactive arthritis also known as Reiter syndrome, is an autoimmune connective tissue disorder that occurs following an infection. It

develops due to the autoimmune response to infection(42).The most important organisms implicated in the pathogenesis of Reactive Arthritis include(42)

- Shigella
- Salmonella
- Campylobacter
- Chlamydia trachomatis

The classic triad of symptoms seen in reactive arthritis are (42)

- 1) Non-infectious Urethritis
- 2) Arthritis
- 3) Conjunctivitis

The diagnosis of Reactive Arthritis is mostly clinical. There is only limited investigations available that will be helpful for the diagnosis of this disease.

Reactive arthritis occurs in all age groups. It is more commonly seen in younger age groups. HLA B27 positivity is strongly associated with this arthritis. There is no specific test for reactive arthritis, but tests like stool sample or swabs taken from throat, vagina, penis to look for any inflammatory changes and

blood tests like erythrocyte sedimentation rate, C-reactive protein to check for levels of inflammation.(42)

PSORIATIC ARTHRITIS:

Thirty percent of people with chronic skin condition psoriasis develop a type of inflammatory arthritis in their course of illness. Psoriatic arthritis patients show HLA-B27 positivity with negative Rheumatoid factor and they are classified under seronegative spondyloarthropathy.(43)

The classical manifestations of this disease includes, (43,44)

- Marginal bone erosions giving rise to a pencil in cup deformity but not pathognomonic for psoriatic arthritis
- Irregular thickening of cortex resulting in periostitis
- Soft tissue swelling of the digits as a result of dactylitis leading to sausage shaped digits
- Asymmetrical inflammation of sacroiliac joint
- Involvement of vertebra resulting in spondylitis
- Commonly involve the proximal and distal interphalangeal joint.
- Severity of joint involvement – arthritis mutilans.

Distal interphalangeal joint involvement is a characteristic feature. Psoriatic arthritis can involve any joint presenting in different patterns. Most often diagnosed by radiologic features.(44)

UNDIFFERENTIATED SPONDYLOARTHROPATHY:

A patient with either enthesopathy with inflammatory back pain or peripheral arthritis but do not meet the criteria of ankylosing spondylitis would be classified as undifferentiated spondyloarthropathy. Undifferentiated spondyloarthropathy do not have any specific features.(45)

Sacroiliitis is milder in undifferentiated spondyloarthropathy than in definite Ankylosing Spondylitis. Few cases do not develop sacroiliitis. Larger joints of the lower limbs is usually involved. Enthesitis involving the Achilles tendon insertion, plantar fascial insertion on the calcaneus and the tibial tuberosity may be seen. Swelling of the digits, although frequently seen in Psoriatic or Reactive Arthritis, can also occur. Patients with this type of SPA usually do not have extra articular features.(45)

HLA B27 positivity incidence seen in undifferentiated spondyloarthropathy is high like all other seronegative spondyloarthropathies.

Population studies suggest that the prevalence of HLA B27 is

between 70 and 84%. There are no specific features for uSPA, diagnosis to be made by combination of history, clinical examination and laboratory tests. Rheumatoid factor is absent in these cases and hence classified as seronegative spondyloarthropathy. (45)

HLA B-27 AND PATHOGENESIS OF SPONDYLOARTHROPATHY:

HLA B27 is a surface antigen present in major histocompatibility complex on chromosome 6. The major role of HLA B27 is to present antigenic peptides to the T cells. (46)

Spondyloarthropathies are strongly associated with HLA B27 positivity (47). Almost 95% of Ankylosing Spondylitis patients remain positive for HLA-B27, which makes this disease to be most strongly associated with the major histocompatibility complex (MHC). Prevalence varies among different ethnic groups. (47) Another spondyloarthropathy strongly associated with HLA-B27 is Reactive Arthritis, but weaker than Ankylosing Spondylitis. In contrast to Ankylosing Spondylitis, Reactive Arthritis is stimulated by bacteria (Chlamydia trachomatis, Yersinia, Salmonella, Shigella, and Campylobacter, Chlamydia pneumoniae). (46)

It is said that HLA-B27 has a direct role in the pathogenesis of spondyloarthropathy because of two reasons.

(1) the independent ethnic groups of particular haplotypes associated with HLA B27.(47)

(2) Development of disease similar to human spondyloarthropathy in a HLA B-27 transgenic rats.(47)

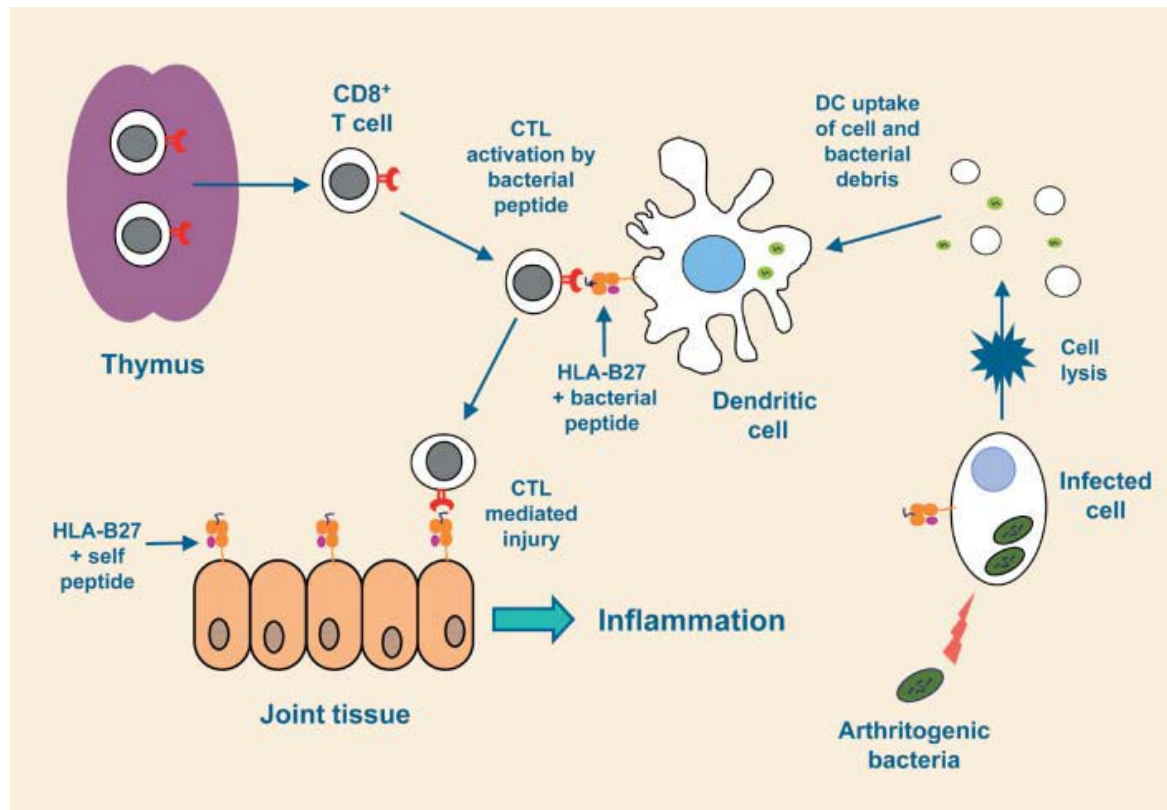
The pathogenic role of HLA-B27 still remains unknown. Most studies regarding the pathogenic role, states that the association of HLA B-27 can be explained by three categories

(1)thearthritogenic peptide hypothesis, which says HLA-B27 has a unique feature of presenting joint specific peptides to cytolyticTcells leading to cross reactivity between bacterial antigens and joint peptides,resulting in stimulation of autoimmune responses.(47)

(2) Unusual T-cell responses and inflammation following T-cell recognition of beta2-microglobulin free HLA-B27 heavy chains(47).

(3) misfolding hypothesis states that accumulation of misfolded HLA-B27 initiates a endoplasmic reticulum(ER) stress responses(47).

ARTHRITOGENIC PEPTIDE MODEL:



HLA-B27-restricted CD8⁺ positive Cytolytic T Lymphocyte which has specificity for bacterial antigens will become active, on presentation of bacterial peptides by dendritic cells. The uptake of debris from bacteria-infected cells leads to cross priming of these activated lymphocytes. Some activated CTL would recognize a The arthritogenic peptide presented by HLA-B27 in the joints will be recognized by some of these activated lymphocytes, resulting in autoimmune mediated injury and inflammation.

CLASSIFICATION CRITERIA:

Due to the lack of definite diagnostic standards, categorization of the patients in to subset of spondyloarthropathies is not easy (50).The Assessment of SpondyloArthritis International Society (ASAS) criteria,a newly developed classification criteria,is based upon clinical manifestations.A 5 to 6 years delay occurs between the onset of symptoms and disease diagnosis especially in HLA-B27 negative patients (51).This delay in diagnosis of the disease caters to the absence of a definite criteria for identifying patients with inflammatory back ache and not able to differentiate it from chronic back pain of mechanical origin.Another reason for delayed diagnosis is the late appearance of sacroilitis findings on plain radiographs.

Classification criteria should be able to define disease groups in epidemiological studies (49).Various classification systems are available which combine different parameters like physical symptoms,signs, biochemical parameters,radiologicalimaging,genetic factors and etiological agents.

The ideal classification criteria is one which should have high specificity,that it should correctly exclude the disease and hence will have low sensitivity.On the othehand,the classification criteria should also have high sensitivity,that is it should make a correct diagnosis, and hence low specificity.There

is no single or specific diagnostic tests in rheumatology and most of the tests done is to identify homogenous patient population for clinical trials.

Inflammatory back pain:

Inflammatory back pain is the most important symptom of the spondyloarthropathies and reflects the inflammation of the spine, entheses and sacroiliac joints. Yet its value in classification, screening and diagnosis is limited. Criteria for inflammatory back pain was derived from clinical studies by comparing the patient with spondyloarthropathy and the patients with back pain of other causes. The sensitivity and specificity of inflammatory back pain does not exist more than 80% (53).

Calin et al (54) included 42 patients with ankylosing spondylitis and 24 patients with back pain of other causes, to study the five features of back pain which includes:

- 1) insidious onset
- 2) disease onset before the age of 40 years
- 3) presence of back pain for more than 3 months
- 4) associated with morning stiffness, and

5) improvement with activity.

Duration of morning stiffness had low sensitivity which was later studied by Gran and found that a duration of more than thirty minutes is associated with ankylosing spondylitis. Initial studies showed 95% specificity and 76% sensitivity, whereas subsequent studies failed to show significant specificity and sensitivity.

Including one more criteria severe pain at night leading to getting out of bed significantly improved the positivity of the criteria(55).

BERLIN CRITERIA:

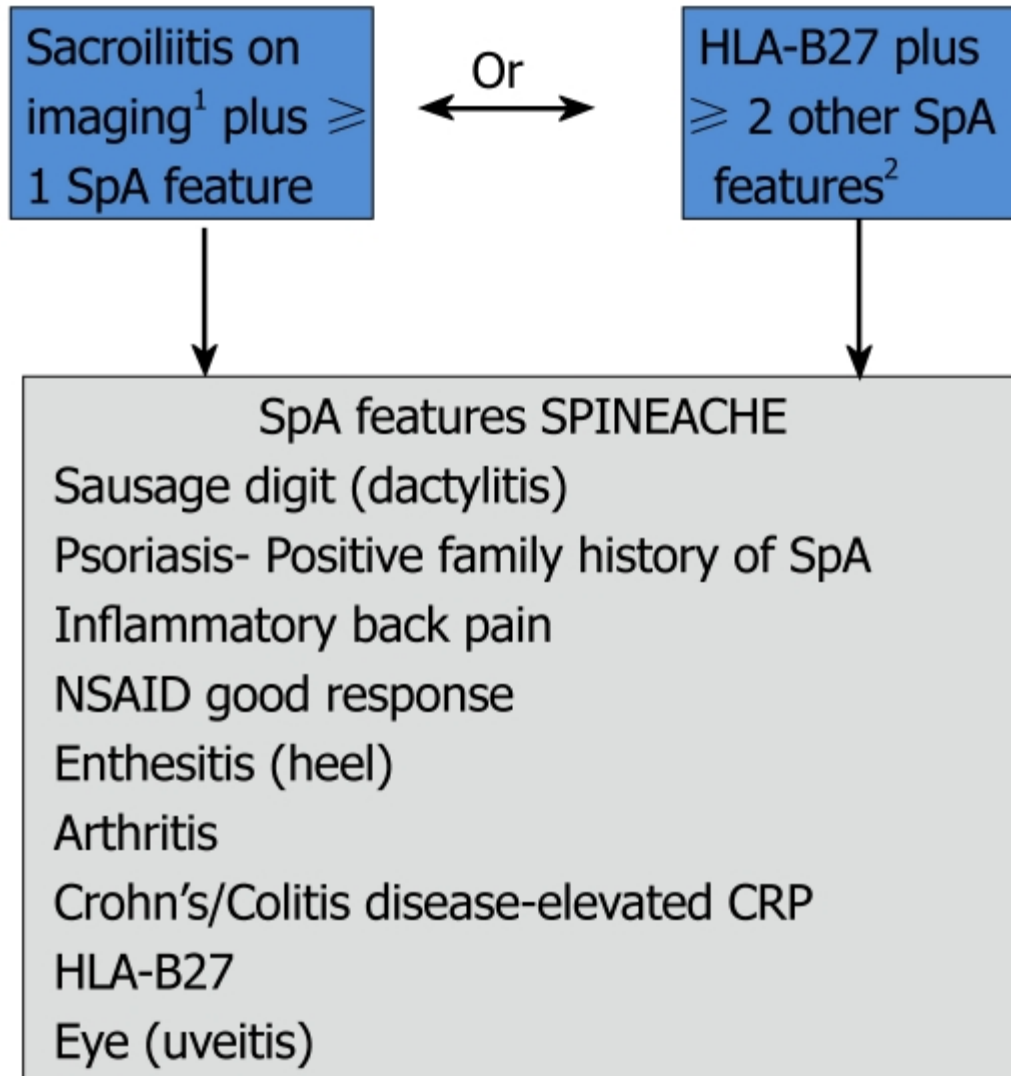
Berlin criteria is developed for early diagnosis of spondyloarthropathy. In this system, the parameters included are, the clinical, laboratory and imaging features. This criteria helps to diagnose new onset axial spondyloarthropathy who had sacroilitis on magnetic resonance imaging, but no radiographic evidence of sacroilitis (56). Berlin's criteria showed that the efficacy of the diagnostic test was similar to European Spondyloarthropathy Study Group and AMOR criteria(57).

ASAS CRITERIA:

ASAS planned to improve spondyloarthropathy criteria particularly in patients with early disease states. It proposed that spondyloarthropathy patients without radiographic evidence of sacroilitis but with predominant axial symptoms can be considered as pre-radiographic phase of ankylosingspondylitis(58). For the classification of axial spondyloarthropathy for patients without radiographic evidence of sacroilitis, ASAS experts developed two standard criterias. This criteria had 82% sensitivity and 84% specificity.

ASAS CLASSIFICATION CRITERIA FOR AXIAL

SPONDYLOARTHROPATHY⁽⁵⁸⁾

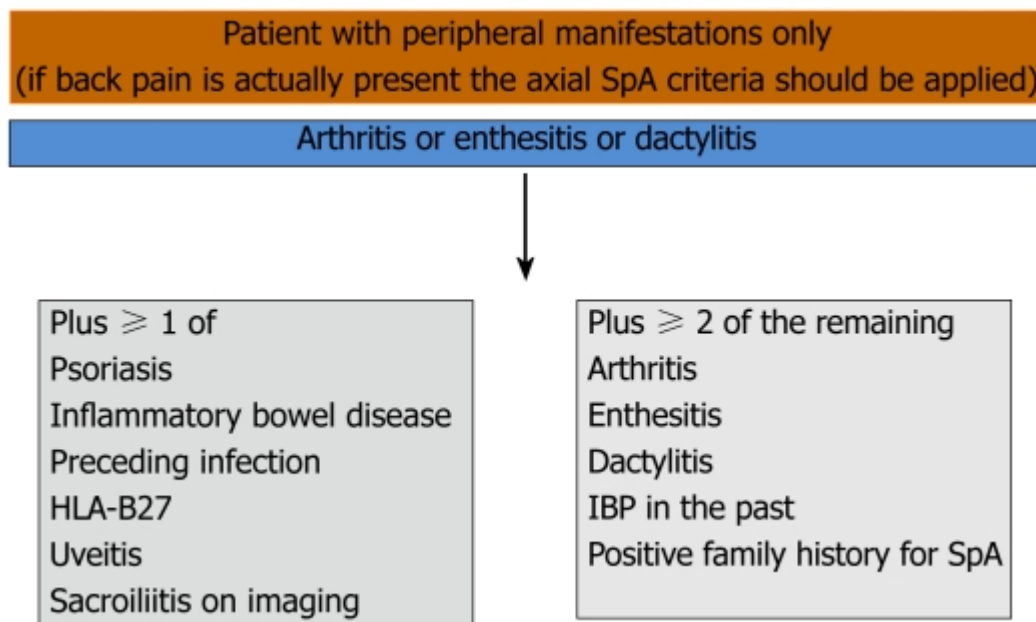


INFLAMMATORY BACK PAIN CRITERIA SETS: (53,54)

‘Calin’s criteria’ for IBP	‘Berlin criteria for IBP’	‘ASAS IBP criteria’
1) disease onset before the age of 40 years	1)Morning stiffness of more than 30 minutes duration	1)Insidious onset
2)Duration of back pain more than 3 months	2)Improvement of back pain with exercise but not with rest	2)Pain at night time
3)Insidious onset		
4)Morning stiffness	3)Nocturnal awakening	3)Age at onset less than 40 years
5)Improvement with exercise	4)Alternating buttocks pain	4)Improvement with exercise
Requires the presence of four of five criteria.	The sensitivity is 70% and specificity 81% if two of the four criteria are present.	The sensitivity is 77% and specificity is 91.7% if at least four out of five criteria are present.

For patients with predominant peripheral arthritis, another criteria was developed. Patients included in this criteria are those having enthesitis without back pain, peripheral arthritis and dactylitis(59).

ASAS CLASSIFICATION CRITERIA FOR PERIPHERAL SPONDYLOARTHROPATHY:(59)



MODIFIED NEW YORK CRITERIA FOR ANKYLOSING SPONDYLITIS:

A patient can be diagnosed as ankylosing spondylitis based upon the modified classification system proposed by Calin et al, and is used by most clinicians. Modified New York Criteria was developed by the integration of Calin's

criteria which defines back pain, as low back ache and stiffness of more than 3 months duration, with improvement of pain following activity and not relieved by rest. A patient can be labelled as ankylosing spondylitis if at least one clinical plus one radiological criteria are met (60).

Modified New York criteria for ankylosing spondylitis(60)

<p><u>CLINICAL CRITERION:</u></p>
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- | |
|---|
| <p>1) Low back ache and stiffness for more than 3 months duration, which improves on physical activity and not relieved by rest.</p> <p>2) Decreased Chest movements relative to normal values correlated for age and sex</p> <p>3) Limitation of motion of the lumbar spine in sagittal and frontal planes</p> |
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<p><u>RADIOLOGICAL CRITERION:</u></p>
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| <p>4a) Unilateral sacroilitis more than grade 3 or</p> <p>4b) Bilateral sacroilitis more than or equal to grade 2</p> |
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<p>Definite ankylosing spondylitis if radiological criterion plus any one of the clinical criterion</p>

AMOR CRITERIA:

Amor proposed a criteria based upon scoring system of biochemical, radiologic and clinical parameters. Each parameters is given one, two or three points and a score of six or more classifies the patient as spondyloarthropathy. Sacroilitis is not mandatory for the diagnosis of spondyloarthropathy, although it was considered specific for spondyloarthropathy and had the highest points in the scoring system(61).

AMOR CRITERIA(61)

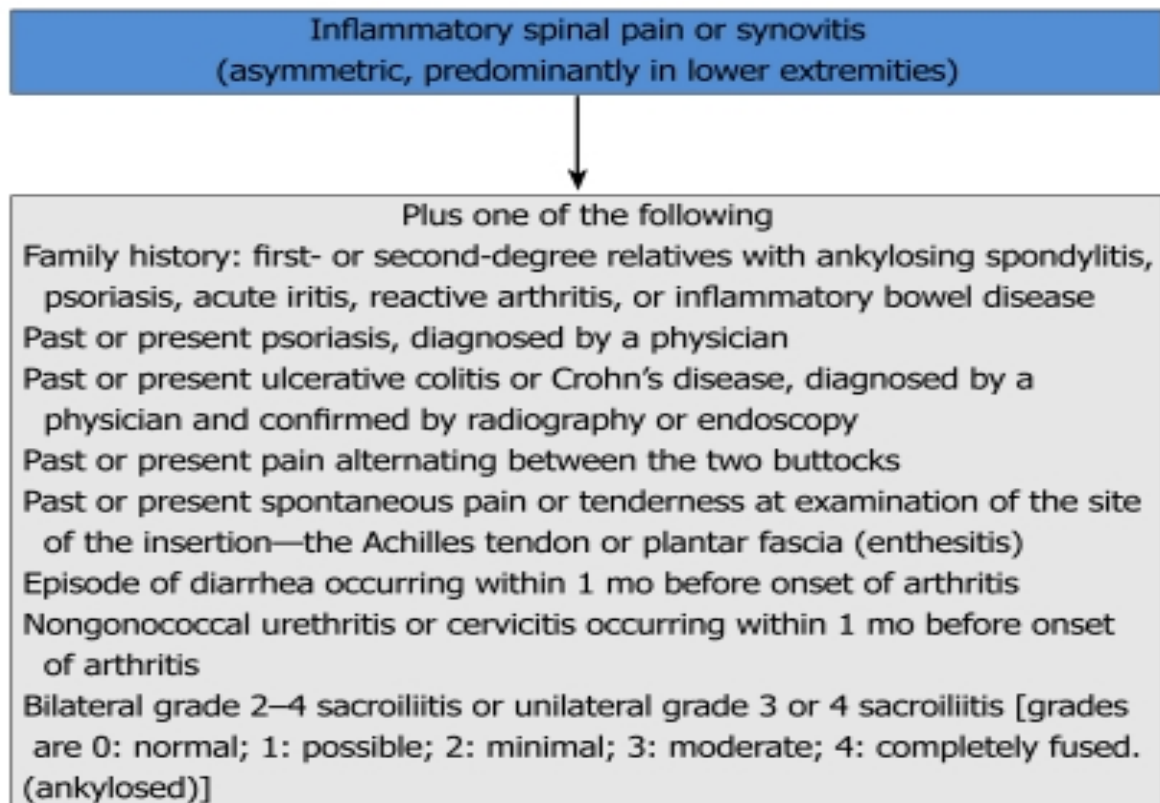
Clinical Symptoms or past history of	Points
Asymmetrical oligoarthritis	2
Lumbar or dorsal pain at night or lumbar or dorsal morning stiffness	1
Buttock pain	1
If alternate buttock pain	2
Heel pain	2
Sausage like toe or digit	2
Nongonococcal urethritis or cervicitis within 1 month before the onset of arthritis	1
Iritis	1

Psoriasis, balanitis, or inflammatory bowel disease	2
Acute diarrhoea within one month before the onset of arthritis	1
<u>Radiologic findings</u> Sacroilitis (bilateral grade 2 or unilateral grade 3)	<u>3</u>
<u>Response to treatment</u> Clear-cut improvement within 48 hours after NSAIDs intake or rapid relapse of pain after discontinuation	2
<u>Genetic background</u> Presence of HLA-B27 and/or family history of ankylosing spondylitis, reactive arthritis, uveitis, psoriasis, or inflammatory bowel disease	2

ESSG criteria:

European Spondyloarthropathy Study Group criteria was proposed in 1991. In this criteria, peripheral arthritis and inflammatory back pain is required. Patients are classified as having spondyloarthropathy with the presence of one of the two features and one minor criterion (62)

The main aim of this criteria is to include undifferentiated spondyloarthropathy. Both ESSG and ARMOR criteria are very useful for diagnosing spondyloarthropathy but, for the diagnosis of early spondyloarthropathy the sensitivity is low(62).



The performance of the modified New York criteria, Berlin, Amor and ESSG criteria was evaluated in patients having 2 years of inflammatory back pain. The highest performance was observed with ESSG criteria accounting for 84%, followed by Amor(71%) and Berlin criteria(65%) (63)

And also found that, the ESSG criteria is the most sensitive, and modified New York criteria the most specific criterias for diagnosing ankylosing spondylitis(63).

CLASSIFICATION CRITERIA FOR PSORIATIC ARTHRITIS

In 1973 Moll and Wright(64) proposed a classification system for psoriatic arthritis. According to this classification, the psoriatic arthritis can be divided into five clinical subsets:

- (1) Asymmetrical Oligoarticular arthritis (not more than 5 tender and swollen joints)
- (2) Predominant distal interphalangeal joint
- (3) Polyarticular arthritis
- (4) Spondylitis
- (5) Predominant arthritis mutilans..

Psoriatic arthritis patients also had inflammatory axial involvement similar to ankylosing spondylitis(64). But there are many features available to differentiate between the two like

- 1) Non-marginal syndesmophytes
- 2) Asymmetrical syndesmophytes
- 3) Asymmetrical sacroilitis
- 4) More frequent involvement of the cervical spine.

Bennet suggested new criteria as he thought Moll and Wright criteria overdiagnosed psoriatic arthritis. This new criteria included radiological and clinical features combined with synovial fluid analysis and histological examination. This criteria also failed because of the difficulty to use the criteria in prospective studies as histological and synovial fluid analysis are not practical(64). Bennett's criteria was simplified by Vasey and Espinoza(65).

Based on enthesopathy, McGonagle et al(66) proposed a criteria. This criteria also posed a problem of MRI requirements. MRI is required to find enthesopathy and synovitis. Some studies compared the different criteria for diagnosing psoriatic arthritis. These studies observed a high sensitivity of 98% in Vasey and Espinoza & McGonagle criterias and low sensitivity for Bennett and ESSG criteria.

The Classification of Psoriatic ARthritis(**CASPAR**) study group collected and analysed the prospective radiological and clinical data from the patients of psoriatic arthritis and patients with other inflammatory arthritis and

proposed a criteria(67).This criteria was found to be less sensitive than Vasey and Espinoza criteria,but more specific.

As this criteria cannot be applied to new-onset disease,its use is limited. The inclusion of family history in the criteria makes CASPAR criteria advantageous over Vasey and Espinoza. The CASPAR criteria can be considered as the criteria accepted universally for classification of psoriatic arthritis(65).

IMAGING OF SACROILIAC JOINT:

Imaging has a major role in the diagnosis of spondyloarthropathypatients. Also it has a role in classification and monitoring the response to the treatment. Radiographic evidence of sacroiliitis is very important in the diagnosis of spondyloarthropathies and plays a major role in the development of classification criteria. But radiographic evidence of sacroiliitis reflects chronic changes which appears late in the disease process(68). And moreover the radiography has a low specificity in the early diagnosis of spondyloarthropathy.

Magnetic resonance imaging helps to visualize actively inflamed areas at sacroiliac joints and in spine in established cases or in early spondyloarthropathy, regardless of disease stage(69). The oldest criteria do not contain MRI findings as a criteria. These criteria were developed, when magnetic resonance imaging was not well established

There are two arms, imaging and clinical arms, in the classification criteria proposed by ASAS for axial spondyloarthropathy. The imaging arm includes either radiographic or magnetic resonance imaging evidence of sacroilitis, which is necessary for assesment of pre-radiographic changes in early spondyloarthropathy.

Bone marrow edema, osteitis, enthesitis, synovitis and capsulitis which are seen in active inflammation associated with spondyloarthropathy can be picked up easily by magnetic resonance imaging. The chronic structural changes such as sclerosis, fat deposition, erosions of joint margins, and bony fusion can also be detected by magnetic resonance imaging(70).

Dynamic Magnetic resonance imaging became a promising tool in the early diagnosis of spondyloarthropathy. The degree of inflammation of the sacroiliac joint can be effectively quantified using dynamic magnetic resonance imaging(10). The enhancement observed in the sacroiliac joint directly reflects the inflammatory process. The amount of enhancement observed in the sacroiliac joint is used to detect the activity and chronicity of the disease(10).

Bollow et al, studied the role of dynamic MRI using FAST spin echo sequence and found that the dynamic MRI has a significant role in early diagnosis of sacroilitis(5).

In another study by Blum et al, which states that, Contrast enhanced MRI is superior to conventional radiography or quantitative SI scintigraphy for the assessment and detection of active changes in the synovial portion and the subchondral bone marrow(8),.

In another study by Braun and Bollow et al, states Computed Tomography guided corticosteroid injection is a useful method in therapy for sacroiliitis in spondyloarthropathypatients. Dynamic magnetic resonance imaging is used to quantitatively assess the different degrees of inflammation(7).

In another study by Bollow et al states the acute and chronic sacroiliitis in children can be effectively detected by dynamic magnetic resonance imaging . The main usefulness of dynamic MRI are the ability to detect acute changes in the sacroiliac joints, the higher sensitivity to detect chronic inflammatory changes, and the lack of radiation exposure(71).

MANAGEMENT:

The treatment aspects of spondyloarthropathies is usually based on patient's clinical presentation and comorbidities. The recommended treatment for ankylosing spondylitis includes

- (1) health education,
- (2) lifestyle modifications,

(3) physiotherapy,

(4) medications, and

(5) frequently looking for progression of the disease.

Patients should be educated about the necessity of strict adherence to treatment regimens and also need to improve their personal hygiene and activity status. Smoking should be avoided as it is related to the worse outcomes of the disease. Patients should be educated to receive influenza and pneumococcal vaccines whenever drugs like tumor necrosis factor- α inhibitors are being used.

Regular exercise for lifelong should be encouraged and should include spinal relaxation exercises, range of motion exercises of the hips, back, shoulder neck, and peripheral joints and deep breathing. Abrupt movements of the spine should not be encouraged.

Short-term physiotherapy followed by lifelong physical activity in the form of exercises will be helpful for patients with spondyloarthropathies. The role of physical therapy is controversial since from the time TNF- α inhibitors became available.

NSAIDs are the drug of choice for patients with the spondyloarthropathies. Varied responses may be seen among patients. So the effective NSAID should be advocated.

Disease-modifying antirheumatoid drugs like gold, methotrexate, sulfasalazine and leflunomide are not used for axial spondyloarthropathy. But they may be used in patients with peripheral arthritis. Patients with enthesitis and monarticular or oligoarticular peripheral arthritis benefit from intra-articular corticosteroid injection.

All the three Tumor Necrosis Factor- α inhibitors, adalimumab, etanercept and infliximab, are highly effective in active spondyloarthropathy patients. These biologic agents are found to be effective in the management of skin and nail manifestations of psoriasis. Adalimumab and Infliximab are effective in the treatment of inflammatory bowel disease, but etanercept has no role. The recurrences of acute anterior uveitis is not effectively prevented by monoclonal antibodies.

The TNF- α inhibitors are effective for long term with the use of single drug without concomitant methotrexate. Response to the treatment is assessed by looking for reduction the levels of C-reactive protein and erythrocyte sedimentation rate, which reflects the intensity of inflammation.

TITLE:

**COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR
IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY
DIAGNOSIS OF SACROILITIS IN SPONDYLOARTHROPATHIES**

AIM:

To quantify the degree of inflammation observed in sacroiliac joint by using dynamic magnetic resonance imaging.

OBJECTIVES:

The objectives of this study were to

- (1) to assess the degree of sacroilitis by calculating the enhancement observed in sacroiliac joint using dynamic MRI
- (2) to directly compare the results of dynamic MRI(the enhancement and histological examination (obtained by sacroiliacbiopsies) by quantitative analysis.

MATERIALS AND METHODS:

At our institution, patients who presented with inflammatory back pain are routinely evaluated in the Orthopaedics and Rheumatology department clinically and then referred for radiological evaluation. The patients graded their back pain on a visual analogue scale with grade 0 – no pain and grade 10 – unbearable pain(5).

Thirtyfive patients between 10-60 YEARS of either sex with inflammatory back pain of atleast grade 5, on a visual analogue scale, was subjected to dynamic magnetic resonance imaging. Then the patient underwent computed tomography guided sacroiliac joint biopsy. Every procedure is combined with an intra-articular steroid injection.

The study was conducted after obtaining proper informed consent from the patient. As this was a prospective controlled study, ethical committee approval from Institutional Ethics Committee, Madras Medical College, was obtained.

Inclusion Criteria

- (1) 10 – 60 years of either sex.
- (2) Patients with ankylosing spondylitis & seronegative spondyloarthropathies
- (3) Patients with unspecified spondyloarthropathy
- (4) Patients with inflammatory back pain of Grade 5 on Visual Analogue Scale
- (5) Inflammatory back pain patients not responding to NSAIDs.

Exclusion Criteria

- (1) Patients with history of previous sacroiliac biopsies
- (2) Non consenting & uncooperative patients
- (3) Patients with contraindications (pacemaker, cochlear implant)
- (4) Patients with bleeding diathesis
- (5) Patients with infection and ulcers in the skin of sacral region
- (6) Pregnant women
- (7) Patients with renal failure.
- (8) Patients showing less than 30% of enhancement are not subjected to biopsy
- (9) Inadequate specimens at biopsy

The characteristics of the patients included in the study are given below.

	Subset s	No: (n = 35)	Age mean(SD)	Male (%)	Mean(SD)) Disease duration	Back pain (VAS 0- 10)	HLA B27 + (%)
	AS	19	35.06(9.6)	73%	4.7(2.4)	6.8	85%
	uSPA	12	31.1(10.1)	83%	6.1(3.7)	7.7	80%
	PsA	4	33.5(9.8)	50%	3.0(1.4)	6.7	75%

Descriptives

		N	Mean	Std. Deviation	Std. Error
AGE	AS	16	35.06	9.657	2.414
	PsA	4	33.50	9.849	4.924
	uSPA	10	31.10	10.137	3.206
	Total	30	33.53	9.669	1.765
DISEASE DURATION	AS	16	4.738	2.4254	.6063
	PsA	4	3.025	1.4705	.7353
	uSPA	10	6.120	3.7300	1.1795
	Total	30	4.970	2.9312	.5352
VAS	AS	16	6.81	1.109	.277
	PsA	4	6.75	1.258	.629
	uSPA	10	7.70	1.337	.423
	Total	30	7.10	1.242	.227

STUDY DESIGN:

The patients were evaluated using modified NEW YORK and European Spondyloarthropathy Study Group criteria to diagnose as Ankylosing Spondylitis, Psoriatic arthritis and unspecified Spondyloarthropathy.

The patients was then subjected to magnetic resonance imaging using 3.0Tesla Magnetom (skyra, Siemens, Germany). The patients are examined in supine position. In all the sequences, axial sections parallel to the cranial part of the sacrum were used.

1) T1 weighted fast spinecho sequences

(TR: 680ms,

TE: 20ms,

slice thickness 4 mm,

2 acquisitions,

matrix 256 x 256,

100% oversampling) and then

2)T2* weighted gradientecho-sequences in opposed phase technique

(30° Flipangle;

TR: 720ms,

TE: 17 ms,
slice thickness 4 mm,
2acquisitions,
matrix 256 x 256,
100% oversampling) were performed.

Additional fat suppression was unnecessary because short tau inversions recovery (STIR) sequences were used.

3)The STIR sequence

(TR: 5910ms,
TE: 44ms,
TI: 230ms,
slice thickness 4 mm,
1 acquisition,
matrix 256 x 256,
100% oversampling) is especially suitable to detect oedematous and inflammatory areas in tissues.

The dynamic examinations were performed by injecting the intravenous contrast agent ,Gadolinium-DTPA (0.1 mmol/kg body weight) and taking single section (eight repetitions, one precontrast, seven postcontrast) using

4) T1 weighted gradient echo sequence in opposed phase technique

(70° Flip angle;

TR: 50 ms,

TE: 7 ms,

slice thickness 4 mm,

two acquisitions,

matrix 256 x 256,

100% oversampling) through the middle of the synovial part of the SIJ.

The enhancement factor was calculated by:

- (a) to visualise areas of enhancement subtract the first image from the last image of the dynamic sequence,
- (b) Then mark the regions of interest in the joint capsule, joint space and periarticular bone marrow using circular ROI'S.
- (c) Finally calculating the maximum degree of enhancement of Sacroiliac joint capsule, of the joint and of the periarticular bone marrow;

The magnetic resonance images obtained were analysed and the inflammation was graded according activity index and chronicity index criteria(7).

MRI GRADING:

ACTIVITY INDEX:

The activity index is calculated using the amount of enhancement shown by sacroiliac joint. The enhancement was calculated as described above.

GRADE	PERCENTAGE OF ENHANCEMENT	INFERENCE
Grade O	< 30 % of enhancement	No sacroilitis
Grade A	30 – 70% enhancement	Moderate sacroilitis
Grade B	>70% of enhancement	Severe sacroilitis

In few cases there will be no findings suggestive of sacroilitis, but the enhancement can be seen in the joint capsule and periarticular bone marrow. This

can be considered as patients having sacroilitis and graded as moderate sacroilitis (Grade 1).

CHRONICITY INDEX:

The chronicity index is calculated by observing the number of chronic changes like joint space narrowing, number of bone erosions and joint fusion.

GRADE	MRI CHARACTERISTICS
Grade 0	No chronic changes
Grade 1	Mild subchondral sclerosis, and/or less than 2 bone erosions
Grade 2	Moderate subchondral sclerosis, and/or more than 2 bone erosions with normal joint space
Grade 3	Severe subchondral sclerosis, and pseudowidening of joint space
Grade 4	Joint fusion- complete ankylosis

CT GUIDED SACROILIAC JOINT BIOPSY:

TECHNIQUE:

CT guided biopsy was done using TOSHIBA'S AESTION 4 slice CT scanner. The patients to be scanned are placed in prone position on scanner. Scan was taken from the lower edge of sacroiliac joint to the upper margin with a section thickness of 2mm and a section interval of 2mm.

The area to be biopsied are decided by looking the previous films for any obvious erosion mostly on the iliac side or the cartilage of the sacroiliac joint. The puncture area was then set on the CT monitor and an imaginary line was drawn from the target to the skin. The distance between the iliac line and this point is measured and the skin puncture area was marked with the help of laser localisation lines and measured data.

Then the sacroiliac area was painted and draped with sterile cloths. Then local anaesthetic, 5ml of 2% lidocaine is injected in to the skin and an incision was made using 11 size blade. 13G COOK's bone biopsy needle is then inserted in to the ligaments of sacroiliac joints under CT guidance to approach the target area, mostly in the synovial cavity between the middle 1/3 and lower 1/3 of the joint.

The needle position was always controlled by CT. The needle core was then withdrawn and the needle is rotated clockwise and anticlockwise, while advancing the needle in to the tissue with a depth of 2mm slowly. After the position of the needle tip was confirmed or rechecked by CT, biopsy taken by withdrawing the needle and sampling the tissues.

A spinal puncture needle was then inserted through the same tract and long acting corticosteroid, triamcinolone acetonide 40 mg in 1.5 ml lidocaine was injected. Sterile dressing was applied over the skin puncture site after withdrawing the needle.

HISTOPATHOLOGICAL EXAMINATION:

The specimens are transferred in to a bottle and fixed with formalin. Then the tissues are embedded with paraffin, after which they are sliced. Histopathological examination was performed by conventional haematoxylin and eosin staining and Goldner staining(72).

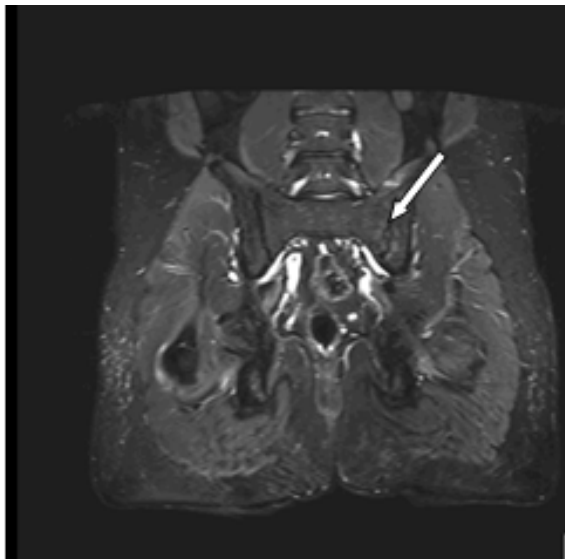
Immunohistological examination was performed by the Alkaline Phosphatase-Anti Alkaline Phosphatase technique (APAAP). Antibodies against leucocytes (CD45), T cells (CD3), macrophages (CD68) and B cells (CD20) were used(72).

By counting the whole specimens, the results are systemically analysed. Only specimens with sections $>3 \text{ mm}^2$ were counted. The relative percentage of bone, cartilage and connective tissue was assessed.

CASE 1

- A 27 year old male came with complaints of low back pain of 8 months duration with early morning stiffness of 30 minutes.
- History of right ankle pain, bilateral shoulder and bilateral knee pain present.
- Visual analog scaling was done and a scoring of 8 was given.
- HLA B27 was positive.
- ESSG criteria was used to classify the disease.

STIR

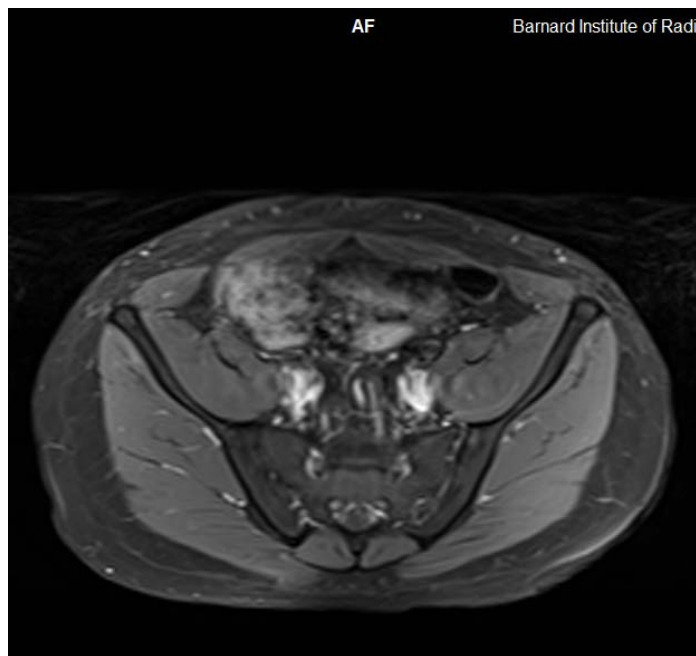


T1 FSE



STIR and T1W FSE images shows periarticular bone marrow edema on left side with out any chronic changes suggestive of grade 1 sacroilitis on left side

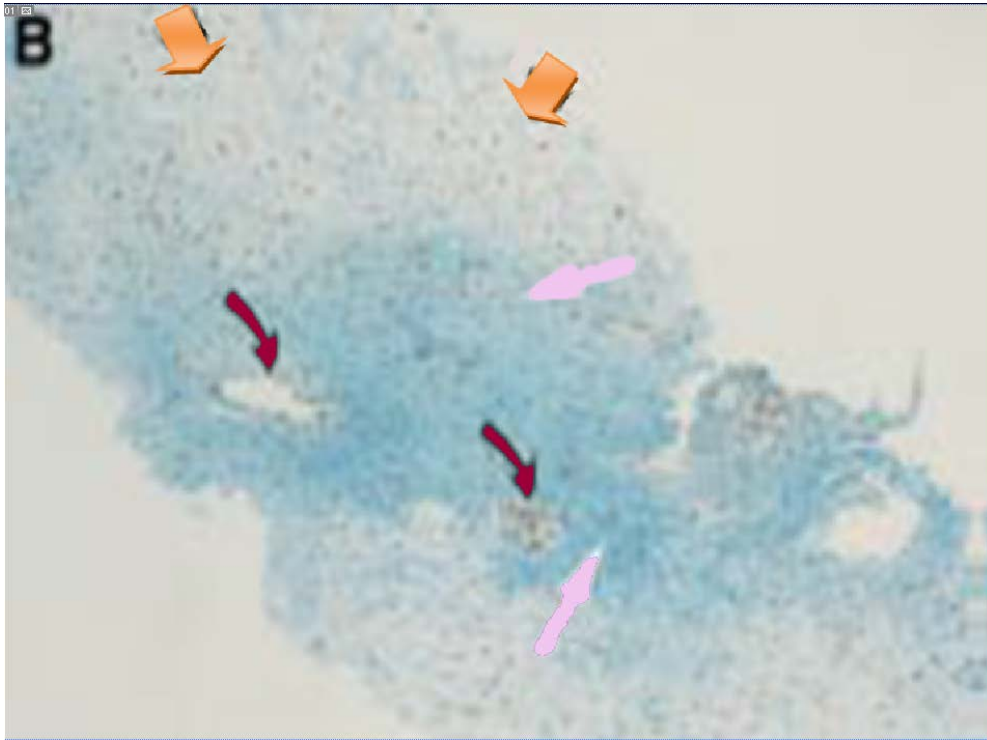
PRE CONTRAST T1WI



POST CONTRAST SUBTRACTED IMAGE



Dynamic T1WI Gradient- pre- contrast & subtracted images shows 80% enhancement in the left sacroiliac joint



The biopsy specimen with Goldner staining shows “fibrocartilaginous metaplasia” with hyaline cartilage a (orange arrows) and cellular infiltrate consisting of fibroblasts (pink arrows) with increased “new blood vessel formation” (brown curved arrows).

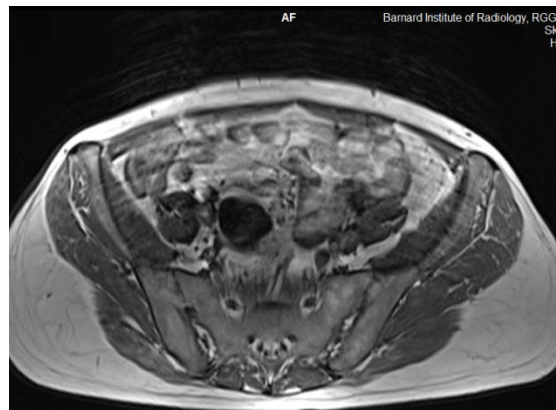
CASE 2

- 25 years old male a known case of unspecified spondyloarthropathy for past 7.2 years. Classified using modified New York and ESSG criteria.
- History of low back ache, right hip pain, bilateral shoulder pain and neck pain present with early morning stiffness of more than 30 minutes.
- Visual analog scale scoring was 9.
- HLA B27 positive.

STIR

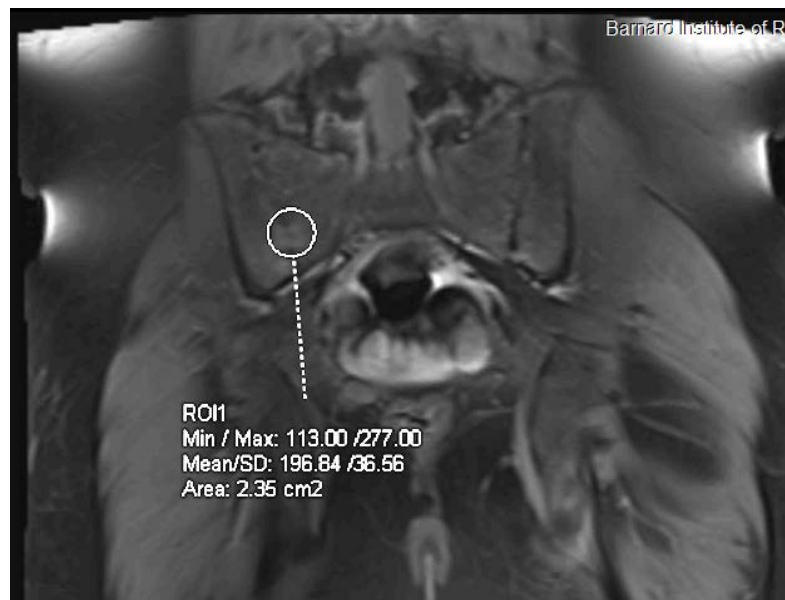


T1 FSE

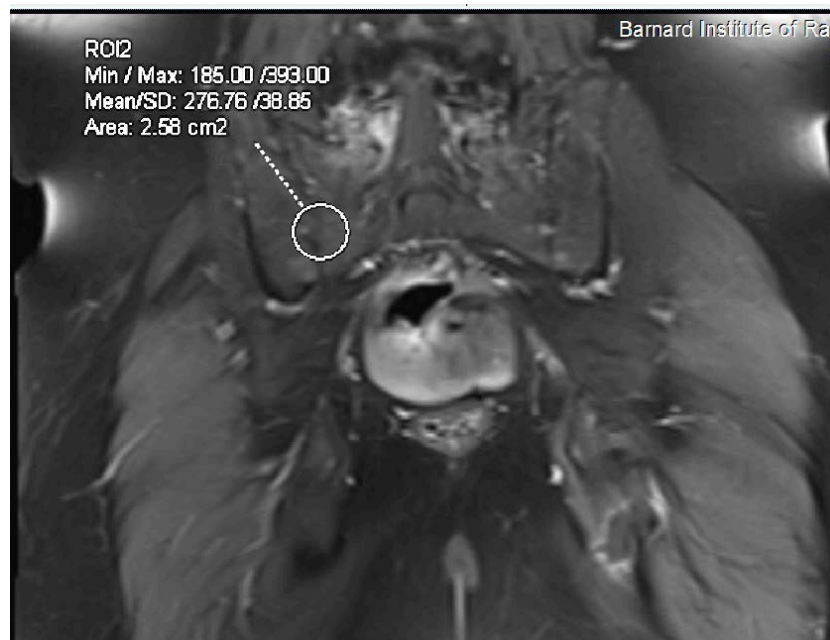


STIR sequence shows bilateral periarticular bone marrow edema and T1 FSE sequence shows some chronic grade 3 sacroiliitis on the right side and grade 2 sacroiliitis on the left

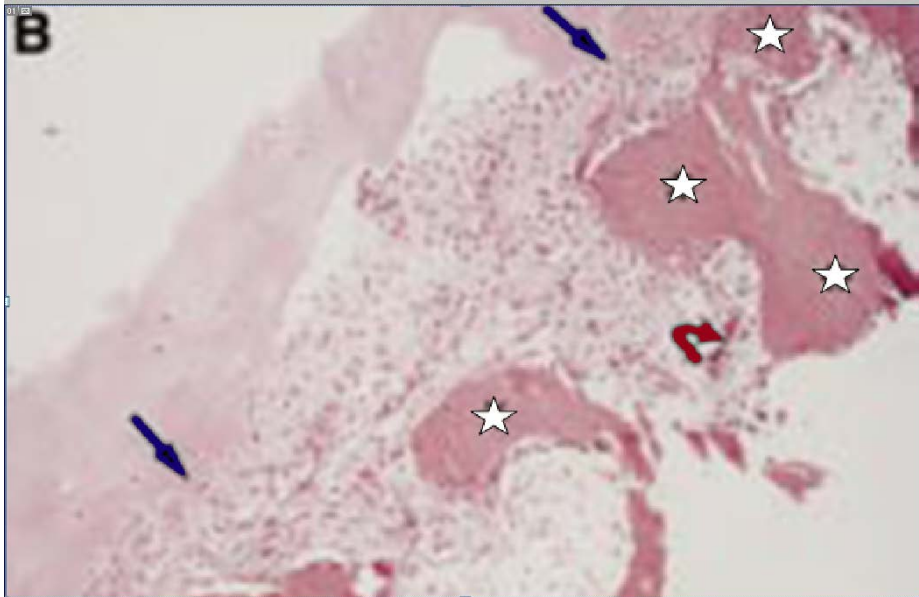
PRE CONTRAST T1WI



POST CONTRAST T1WI



T1WI GRE pre-contrast and subtracted coronal reformatted images shows 40% enhancement in right sacroiliac joint



The histological specimen above shows the cartilage partly invaded by a subchondral infiltrate (blue colour arrows).

There are activated lymphocytes & fibroblasts in the infiltrate.

Areas of avital bone fragments (curved brown colour arrow) with areas of bone formation (stars) and calcifications are seen.

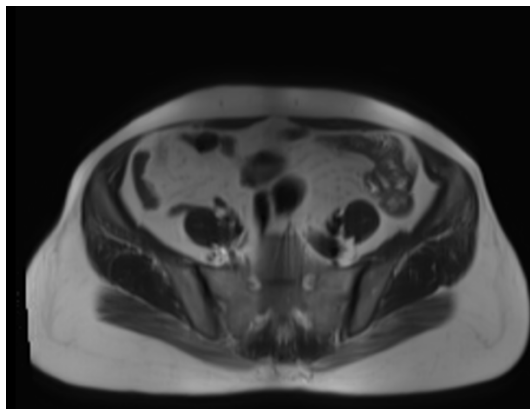
CASE 3

- 40 years old female patient came with complaints of neck pain for past 5.5 years.
- History of low back pain on & off.
- Patient have skin lesions and diagnosed as psoriasis.
- Visual analog scale scoring was 7.
- HLA B27 was negative.

STIR

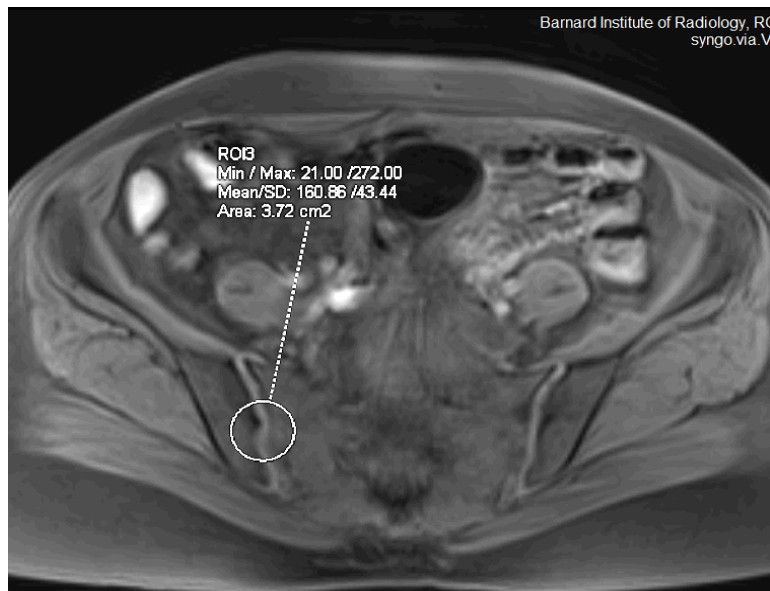


T1 FSE

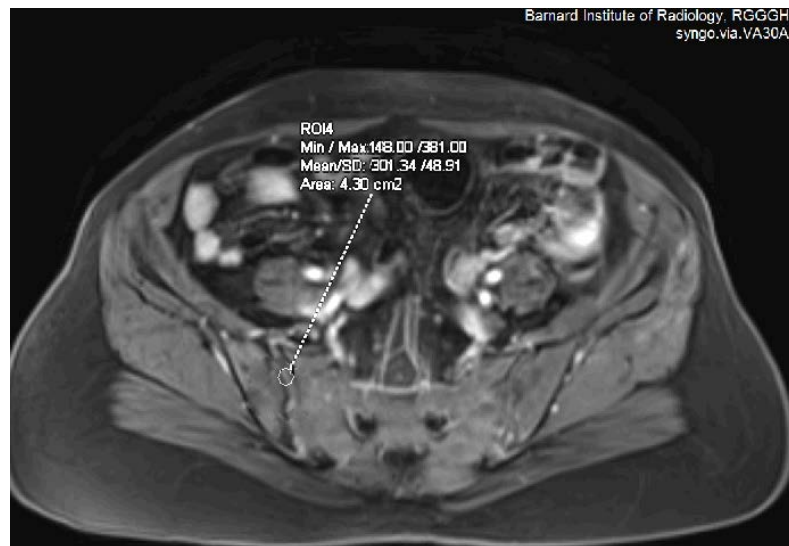


STIR and T1 FSE sequences shows asymmetrical bilateral sacroiliitis with right > left as seen by bone marrow edema and few chronic changes noted on right side- grade 1 on left and grade 2 on right

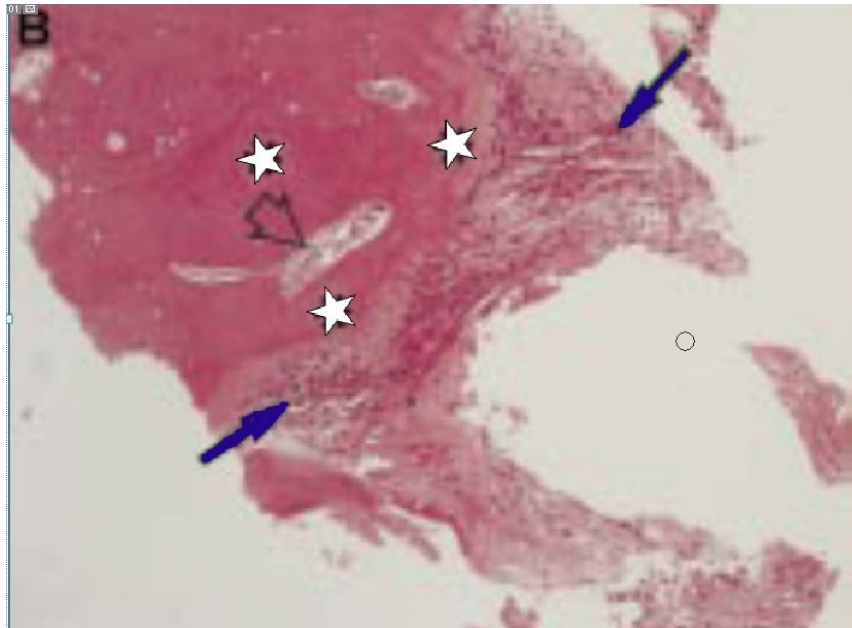
PRE CONTRAST T1WI



POSTCONTRAST T1WI



Pre and post contrast T1WI shows more than 70 % enhancement in both sacroiliac joints and mild chronic changes suggestive of grade 1 sacroilitis on left and grade 2 sacroilitis on right

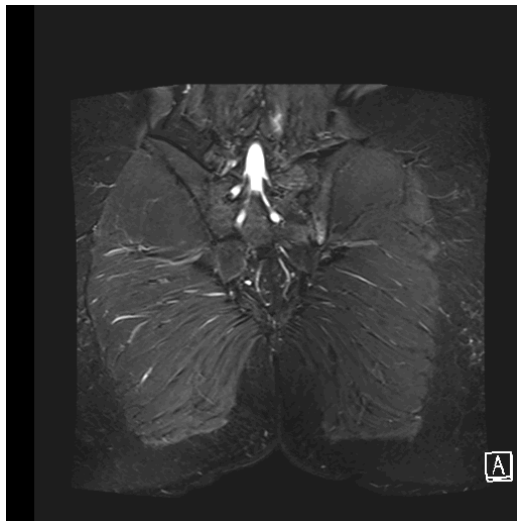


The biopsy specimen shows a “dense cellular infiltrate” (blue colour arrows) with new bone formation (black open arrow) and consisting mainly of lymphocytes and fibroblasts close to a bony area (stars).

CASE 4

- 35 years old male with history of low back pain for past 5.5 years with early morning stiffness of 30 minutes
- History of right knee pain was present
- Visual analog score was 5
- Modified New York criteria is used to classify the disease
- HLA B27 was positive

STIR

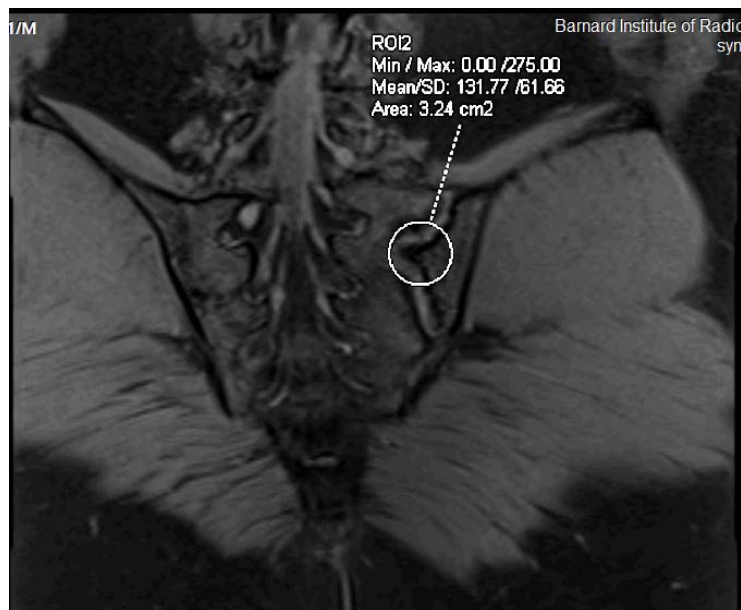


T1WI FSE



STIR and T1WI FSE images shows ankylosed joint on right side with pseudowidening of joint space on left side suggestive of grade 4 sacroilitis on right and grade 3 sacroilitis on left side

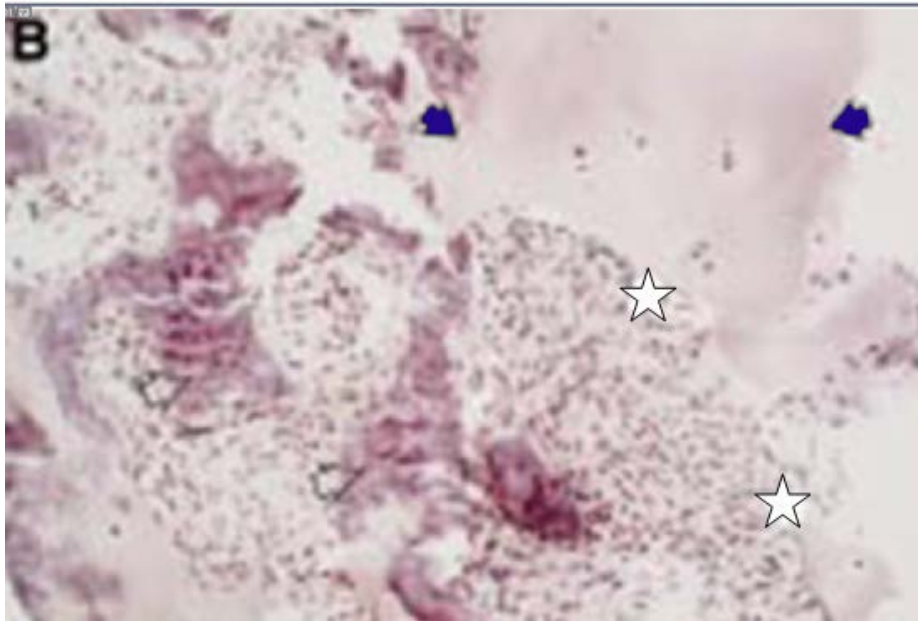
PRE CONTRAST T1WI



POST CONTRAST T1WI



Pre and post contrast dynamic T1WI shows 40% enhancement in left sij and 30% enhancement in right sij suggestive of grade 4 sacroilitis on right side and grade 3 sacroilitis on left side



The biopsy specimen using immunohistology, eosin & haematoxylin staining shows a cellular infiltrate that mainly contains CD45+ lymphocytes and activated fibroblasts (white colour stars) and also invading a degenerate cartilaginous area (blue colour arrows). Areas of bone formation and calcification (open black arrows) are seen in the middle.

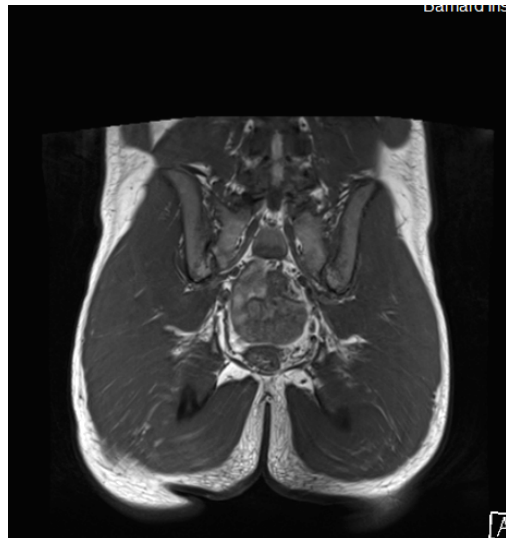
CASE 5

- 22 years old male came with complaints of back pain for past 1.5 years and early morning stiffness for more than 30 minutes.
- HLA B27 was positive
- History of bilateral knee pain and bilateral ankle pain was present
- Visual analog scale scoring was 7
- Modified New York criteria is used to classify

STIR CORONAL

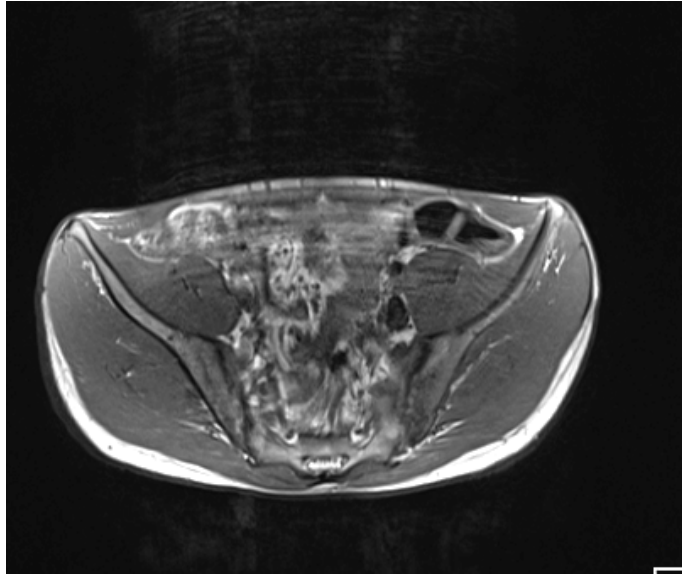


T1WI CORONAL

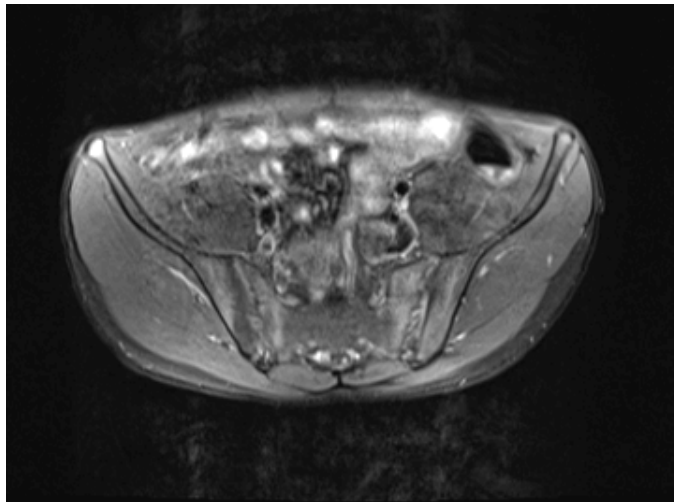


STIR and T1 FSE images shows that bilateral sacroiliitis with significant edema and mild chronic changes suggestive of bilateral grade 2 sacroiliitis

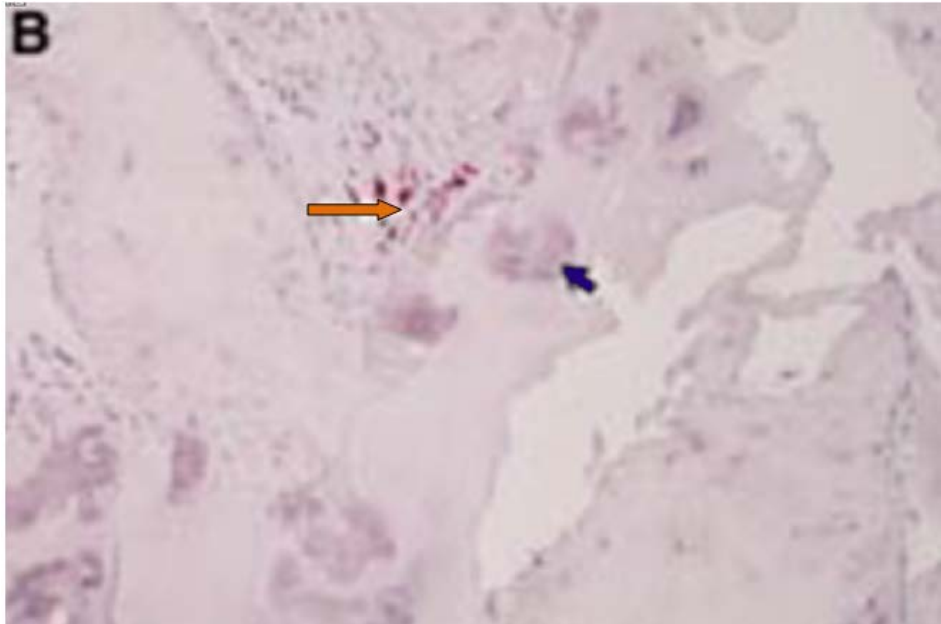
PRECONTRAST T1WI AXIAL



POST CONTRAST DYNAMIC T1WI AXIAL



Pre and post contrast dynamic T1W images shows 70% enhancement in both sacroiliac joints suggestive of grade 2 sacroiliitis



The biopsy specimen with eosin and haematoxylin staining shows “an inflammatory cellular infiltrate (orange arrow) invading a cartilaginous area and also containing CD3+ T lymphocytes and chondroclasts. Some chondrocytes appear hypertrophic”.

STATISTICAL ANALYSIS AND RESULTS:

The collected data was analysed with SPSS 16.0 version. To describe the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables.

To find the significant difference between the bivariate samples in Independent groups the Mann-Whitney U test was used. To find the significance in categorical data Chi-Square test was used. In both the above statistical tools the probability value .05 is considered as significant level.

DISTRIBUTION OF DISEASE :

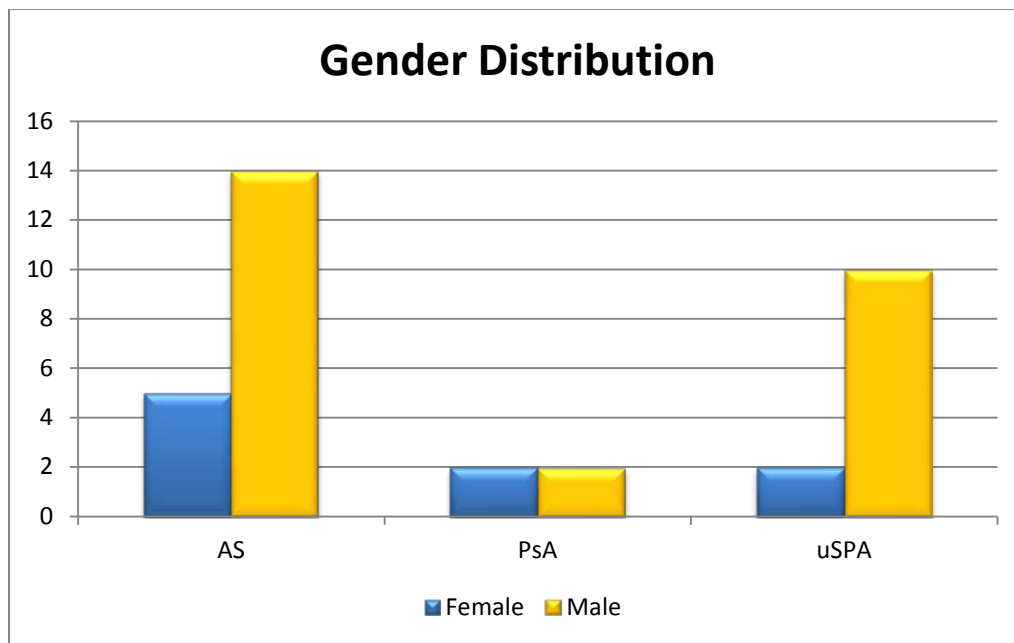
The distribution of the disease among the subsets of spondyloarthropathies was studied using chi-square

Crosstabs					
CRITERIA * SEX					
Crosstab					
			SEX		Total
			F	M	
CRITERIA	AS	Count	5	14	19
		% within SEX	55.6%	53.8%	54.3%
	PsA	Count	2	2	4
		% within SEX	22.2%	7.7%	11.4%
	uSPA	Count	2	10	12
		% within SEX	22.2%	38.5%	34.3%
Total		Count	9	26	35
		% within SEX	100.0%	100.0%	100.0%

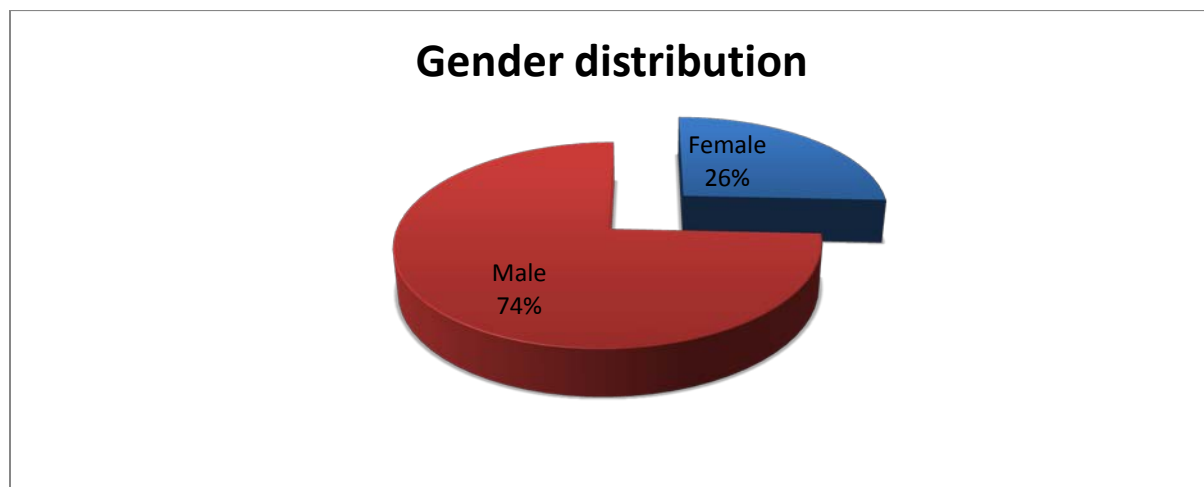
Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.753 ^a	2	.416
Likelihood Ratio	1.644	2	.440
N of Valid Cases	35		

a. 4 cells (66.7%) have expected count less than 5.

Distribution of gender among the subgroups of spondyloarthropathy given by
bar diagram and pie chart



Female	9
Male	26



COMPARISON OF MRI ACTIVITY INDEX WITH BIOPSY SPECIMENS:

Thirty out of 35 specimens were suitable for histological evaluation (83%).

By Dynamic MRI, enhancement < 70% was found in sixteen (group A, and > 70% in 14 patients.

There were more inflammatory cells in Grade B (18.14 (SD-3.4) than in Grade A (8.63 (SD-1.9)

NPar Tests

Mann-Whitney Test

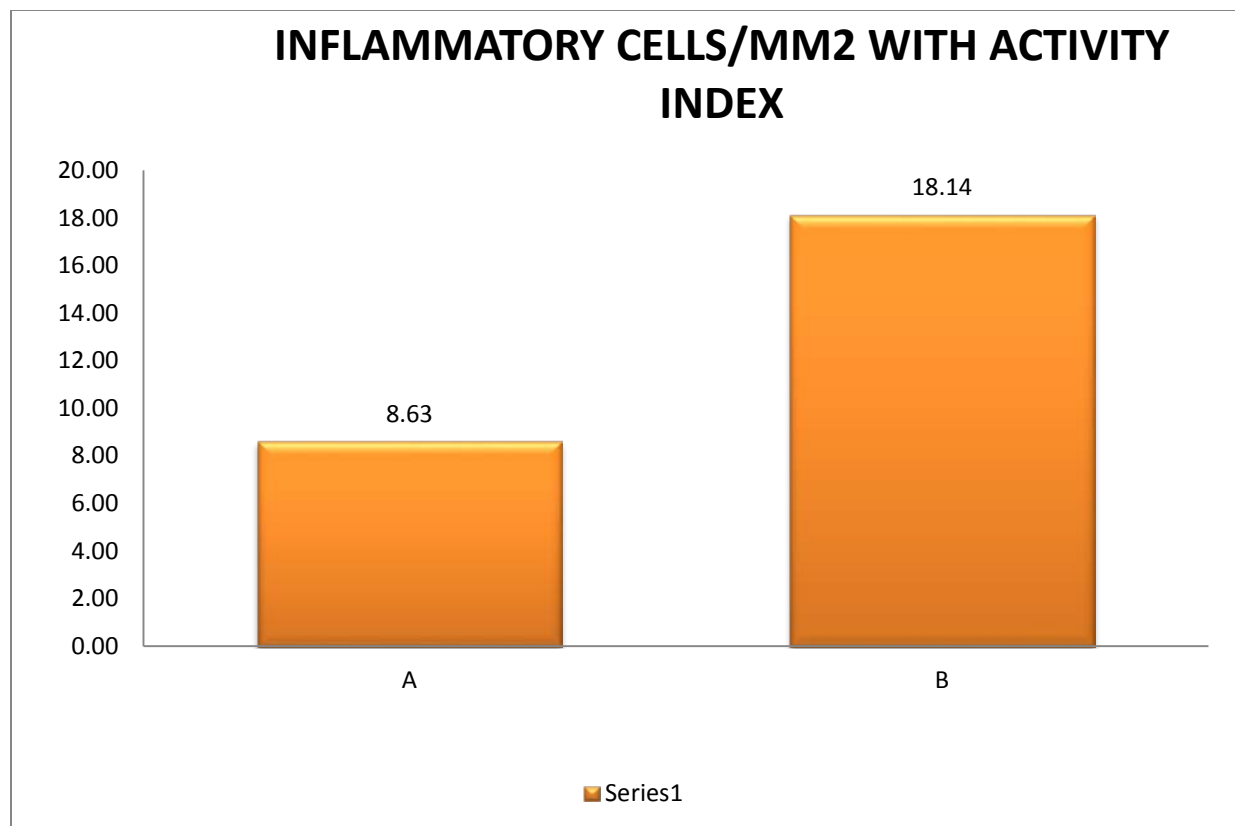
Ranks

ACTIVITY		N	Mean Rank	Sum of Ranks
INFLAMMATORY CELLS/M2	A	16	8.63	138.00
	B	14	23.36	327.00
	Total	30		

Group Statistics

ACTIVITY		N	Mean	Std. Deviation	Std. Error Mean
INFLAMMATORY CELLS/M2	A	16	8.63	1.928	.482
	B	14	18.14	3.416	.913

Test Statistics ^a	
	INFLAMMATORY CELLS/MM2
Mann-Whitney U	2.000
Wilcoxon W	138.000
Z	-4.616
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 ^b
a. Grouping Variable:	
b. Not corrected for ties.	



For comparison purpose, patients with chronic changes on MRI, was divided in to two groups. Those with less than or equal to grade 2 changes are classified as Group 1 and those with more than Grade 2 changes are classified as Group 2.

Sixteen patients belong to Group 1 and fourteen patients belong to Group 2

There were more inflammatory cells in Group 1 (16.8 (SD-4.7) than in Group 2 (8.25 (SD-2.3))

COMPARISON OF MRI CHRONICITY INDEX WITH BIOPSY

SPECIMENS:

NPar Tests

Mann-Whitney Test

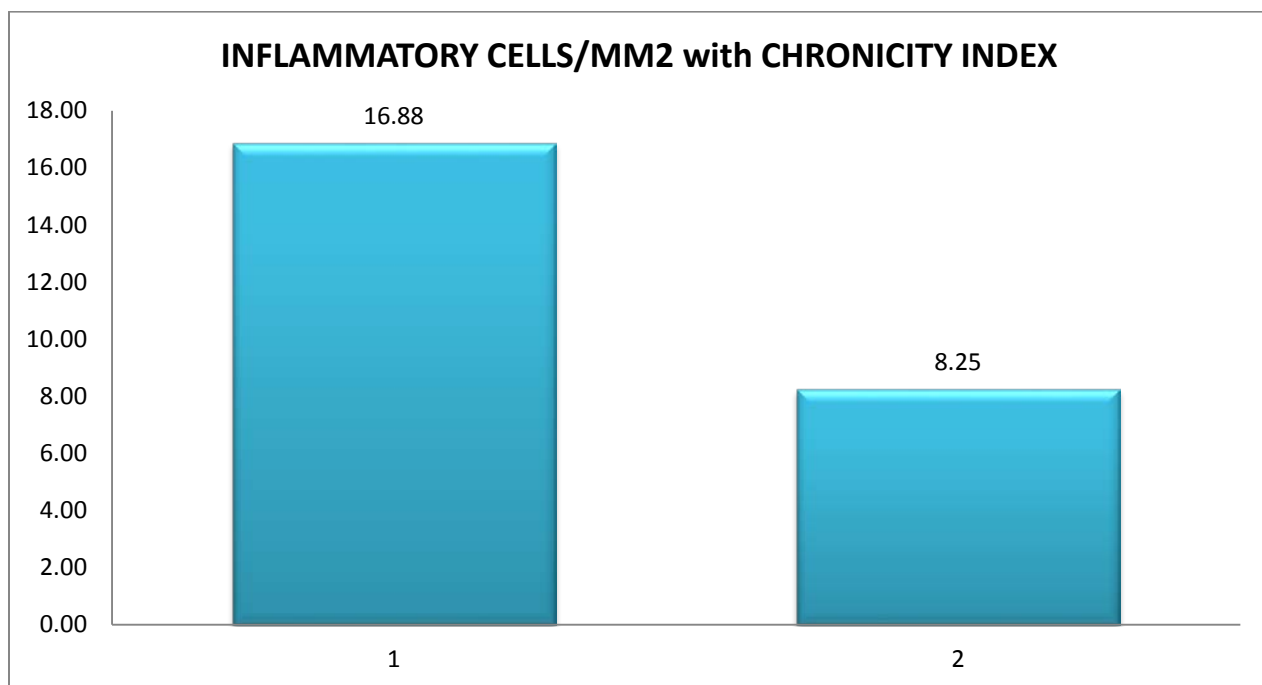
Ranks

CHRONICITY		N	Mean Rank	Sum of Ranks
INFLAMMATORY CELLS/mm ²	1	16	23.31	373.00
	2	14	9.69	155.00
	Total	30		

Group Statistics

CHRONICITY		N	Mean	Std. Deviation	Std. Error Mean
INFLAMMATORY CELLS/mm ²	1	16	16.88	4.703	1.176
	2	14	8.25	2.324	.581

Test Statistics ^a	
	INFLAMMATOR Y CELLS/MM2
Mann-Whitney U	19.000
Wilcoxon W	155.000
Z	-4.142
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 ^b
a. Grouping Variable:	
b. Not corrected for ties.	



Fourteen of sixteen patients in Group 1 with chronic changes less than Grade 2 showed Grade B (more than 70%) enhancement (87%) and two of sixteen patients with less than Grade 2 changes showed Grade A (30 – 70%) enhancement (13%).

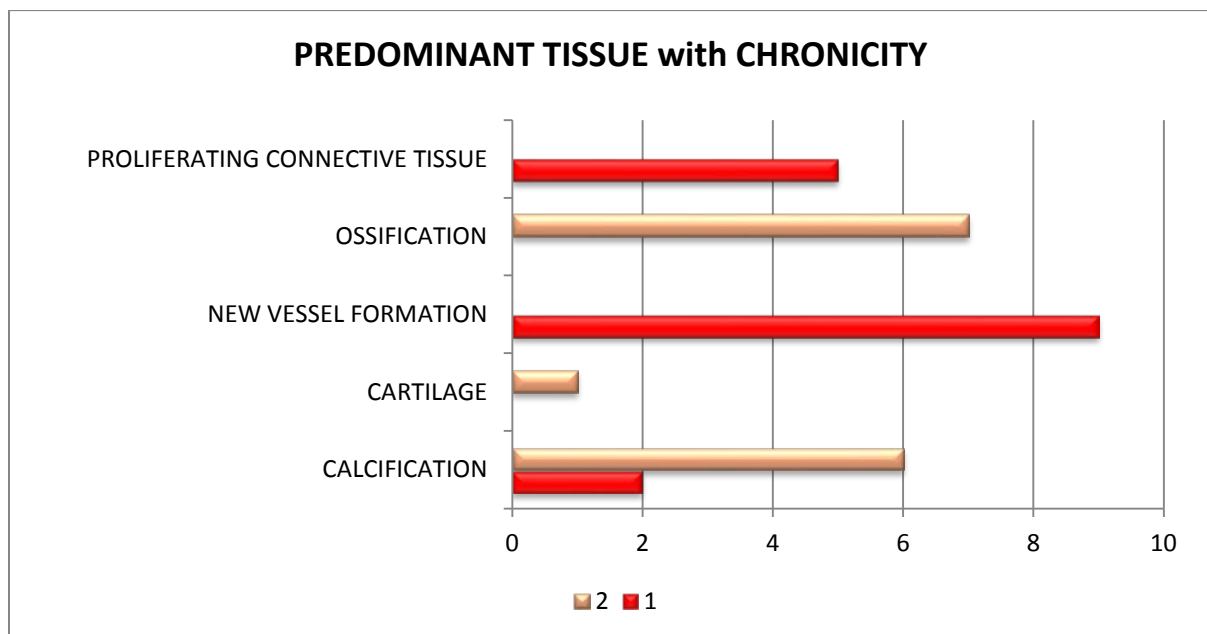
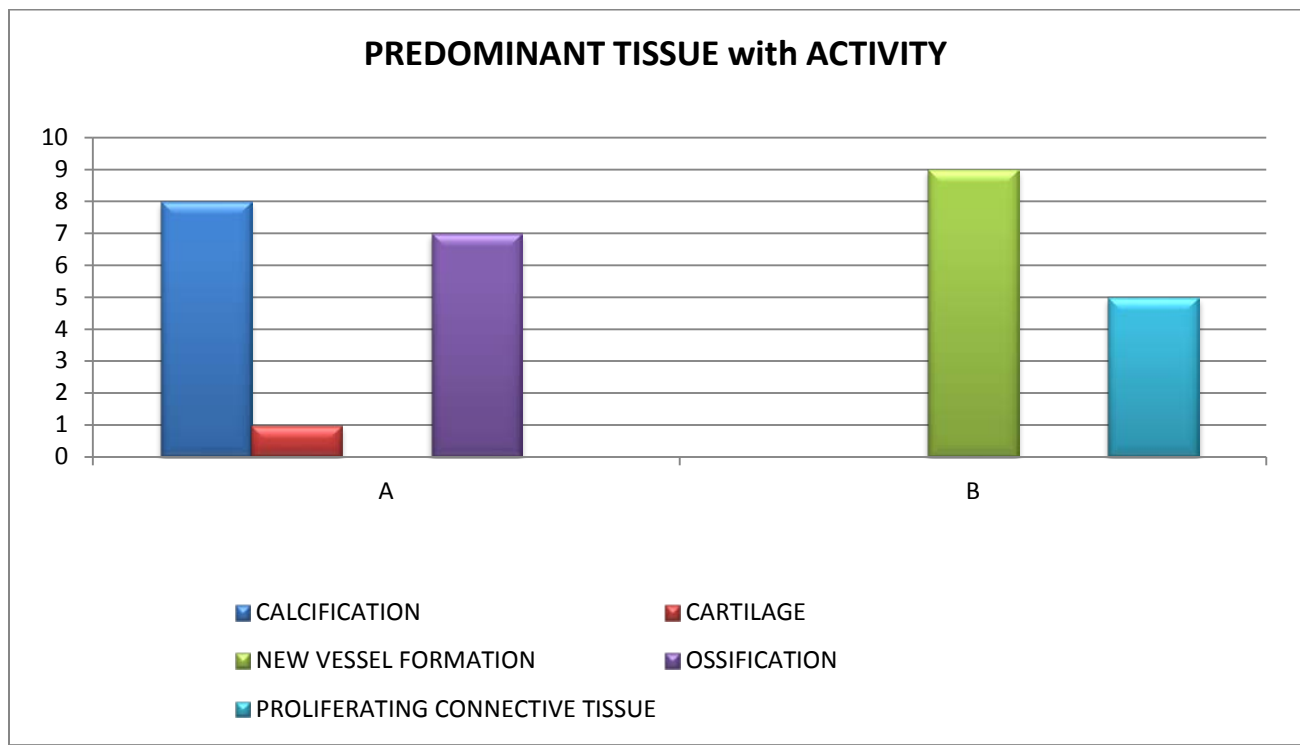
All fourteen patients with more than Grade 2 changes (Group 2) showed Grade A enhancement.

There was significant difference in disease duration between Grade 1 and Grade 2 was noted.

COMPARISON OF TISSUES:

The relative percentage of bone, cartilage and proliferating connective tissue was comparable between the groups (range).

In general, in patients with active sacroilitis and short disease duration the characteristic proliferative connective tissue was found more often and more intense, while in longstanding disease calcification and ossification was more often and more severely found.



PREDOMINANT TISSUE * ACTIVITY

Crosstab

			ACTIVITY		Total
			A	B	
PREDOMINANT TISSUE	CALCIFICATION	Count	8	0	8
		% within ACTIVITY	50.0%	0.0%	26.7%
	CARTILAGE	Count	1	0	1
		% within ACTIVITY	6.3%	0.0%	3.3%
	NEW VESSEL	Count	0	9	9
		% within ACTIVITY	0.0%	64.3%	30.0%
	OSSIFICATION	Count	7	0	7
		% within ACTIVITY	43.8%	0.0%	23.3%
	PROLIFERATION	Count	0	5	5
		% within ACTIVITY	0.0%	35.7%	16.7%
Total		Count	16	14	30
		% within ACTIVITY	100.0%	100.0%	100.0%

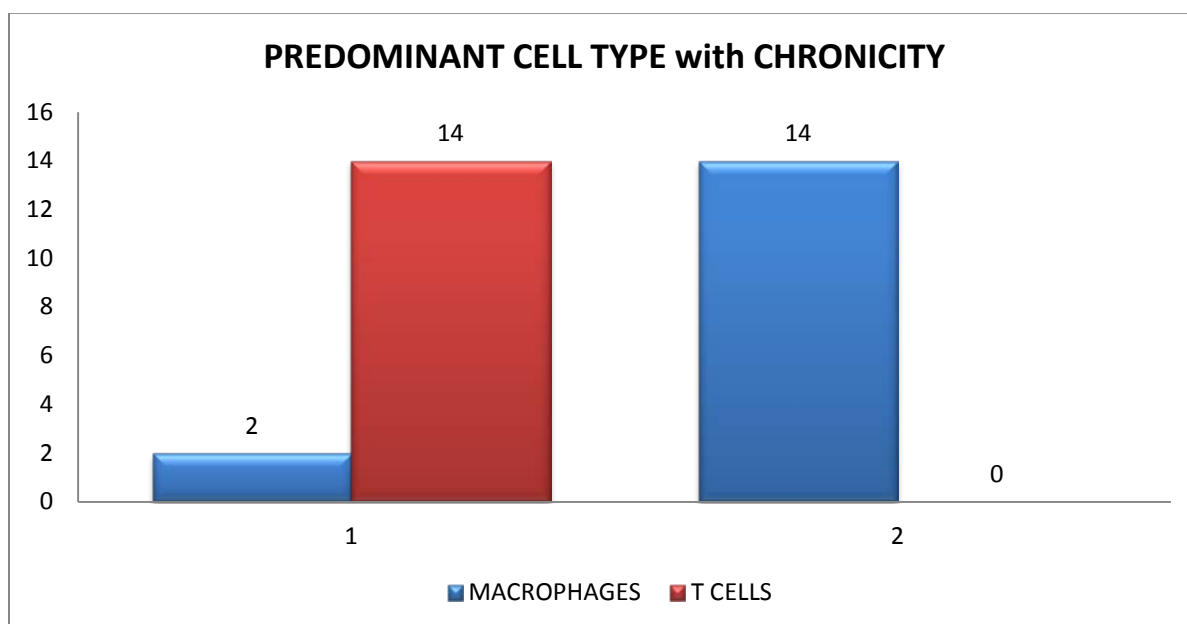
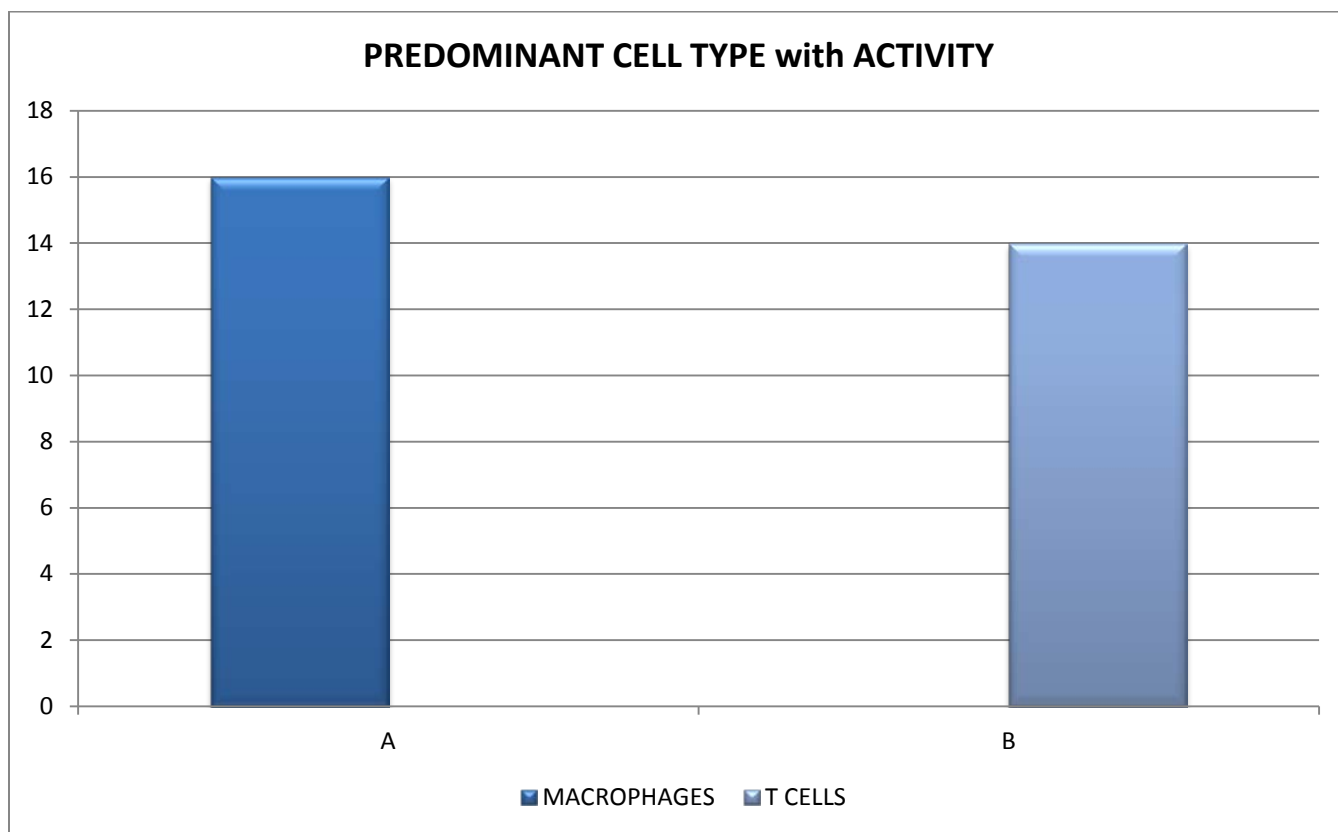
PREDOMINANT TISSUE * CHRONICITY

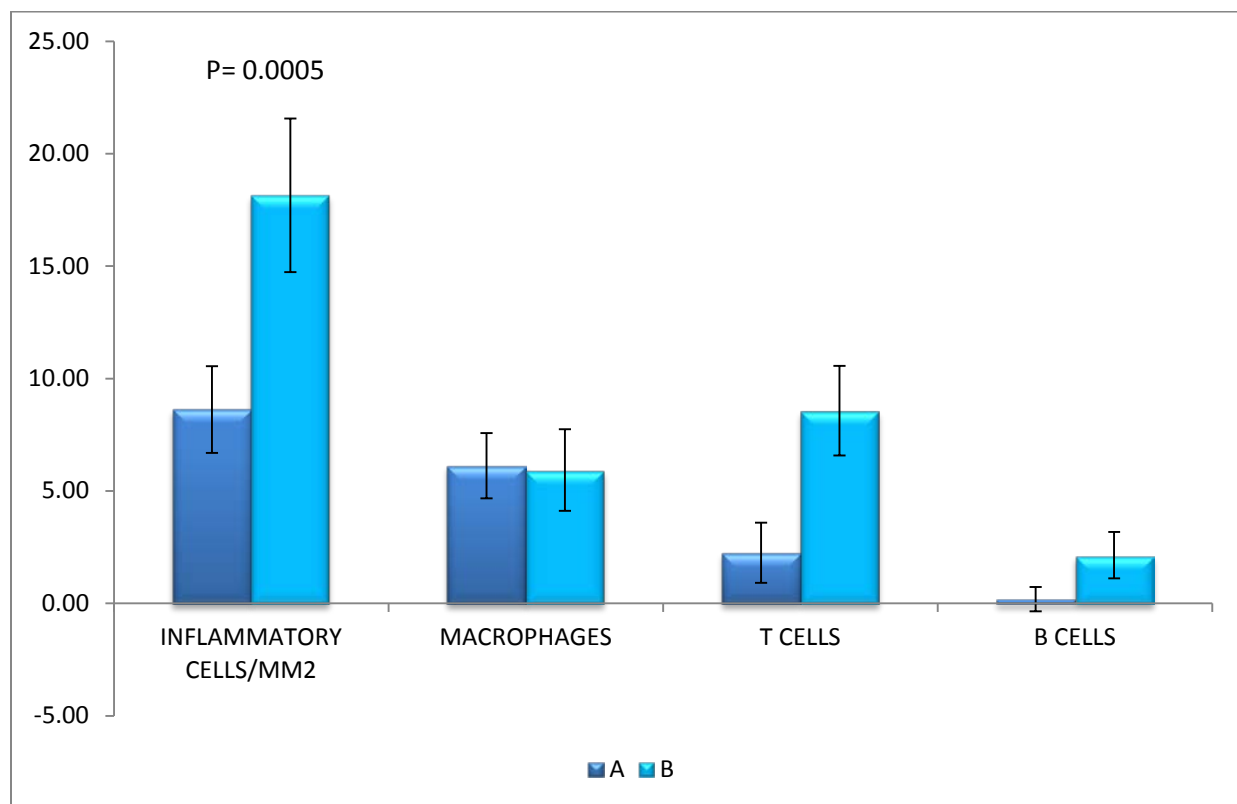
Crosstab					
			CHRONICITY		Total
			1	2	
PREDOMINANT TISSUE	CALCIFICATION	Count	2	6	8
		% within CHRONICITY	12.5%	42.9%	26.7%
	CARTILAGE	Count	0	1	1
		% within CHRONICITY	0.0%	7.1%	3.3%
	NEW VESSEL	Count	9	0	9
		% within CHRONICITY	56.3%	0.0%	30.0%
	OSSIFICATION	Count	0	7	7
		% within CHRONICITY	0.0%	50.0%	23.3%
	PROLIFERATION	Count	5	0	5
		% within CHRONICITY	31.3%	0.0%	16.7%
Total		Count	16	14	30
		% within CHRONICITY	100.0%	100.0%	100.0%

COMPARISON OF PREDOMINANT CELL TYPE IN ACTIVITY AND CHRONICITY INDEX:

T cells being slightly more frequent than macrophages in patients showing Grade B enhancement and Group 1 whereas macrophages are predominantly seen in patients with Grade A and Group 2; this difference was insignificant.

Increased number of T cells and Macrophages in the specimen reflects the presence of immune related pathology in spondyloarthropathies





PREDOMINANT CELL TYPE * ACTIVITY

Crosstab

			ACTIVITY		Total
			A	B	
PREDOMINANT CELL TYPE	MACROPHAG	Count	16	0	16
		% within ACTIVITY	100.0%	0.0%	53.3%
	T CELLS	Count	0	14	14
		% within ACTIVITY	0.0%	100.0%	46.7%
Total		Count	16	14	30
		% within ACTIVITY	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	30.000 ^a	1	.000		
Continuity Correction ^b	26.117	1	.000		
Likelihood Ratio	41.455	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	30				

PREDOMINANT CELL TYPE * CHRONICITY

Crosstab

			CHRONICITY		Total
			1	2	
PREDOMINANT CELL TYPE	MACROPHAGE	Count	2	14	16
		% within CHRONICITY	12.5%	100.0%	53.3%
	T CELLS	Count	14	0	14
		% within CHRONICITY	87.5%	0.0%	46.7%
Total		Count	16	14	30
		% within CHRONICITY	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	22.969 ^a	1	.000		
Continuity Correction ^b	19.588	1	.000		
Likelihood Ratio	29.399	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	30				

a. 0 cells (.0%) have expected count less than 5. The minimum expected

b. Computed only for a 2x2 table

DISCUSSION:

From the above findings, it is clearly evident that the inflammatory cells, Macrophages and T cells are predominant cells seen in early spondyloarthropathy. This also favors the presence of immune mechanism involved in the pathogenesis of spondyloarthropathies.

Also the study proves that the gadolinium DTPA enhanced dynamic magnetic resonance imaging correlates well with the inflammatory cells and very useful to detect active and early sacroilitis.

This study also supports that the magnetic resonance imaging is the imaging investigation of choice in early spondyloarthropathies. Whenever a high degree of enhancement is observed, we should think of a very active disease.

The STIR technique used here is one of the most important sequences, very much sensitive in detecting edema and active inflammation. But with this technique alone, very early spondyloarthropathies may be missed. Very small inflamed areas could not be picked up by STIR sequence and quantification of inflammatory cells can not be done with this technique. The combination of the sequences used in this study helps to diagnose early and active spondyloarthropathies. Opposed phase and STIR techniques are used.

DIFFICULTIES IN TAKING BIOPSY :

The successful biopsy procedures is the one in which the specimens obtained are good enough to be stained with monoclonal antibodies. The limitations of biopsy are

- (a) too difficult access to the joint.
- (b) new bone seen in the dorsal part of the joint and
- (c) insufficient penetration of the biopsy needle.

The sacroiliac joints are structures that are located deeply having articular surface in L shape. The approximate length of the sacroiliac joint is 4.2cm. The upper 1/3 of the joint is fully ligamentous, middle 1/3 of the joint is partly ligamentous (posterior) and partly synovial (anterior), and the lower 1/3 of the joint is fully synovial.

The target of the biopsy needle should be in the synovial portion of the joint that is between middle 1/3 and lower 1/3 of the joint. Tendency of the surface is also flat for easier insertion of the needle. X-ray imaging cannot guide needle in to the joint effectively due to overlap of the images. Ultrasound cannot image the joint properly. Computed tomography is free from image overlap problems

and has good spatial resolution. So Computed Tomography is very good in localisation and guidance of the needle in case of sacroiliac joint puncture.

The scan thickness should be between 2 to 3mm to avoid partial volume effect and also the image quality will be better so that the sacroiliac joint articular surface better displayed for guiding the needle.

Another difficulty is in the localisation of the material obtained. The relative amounts of bone, cartilage and connective tissue obtained were comparable which indicates that a bias has not occurred by biopsying more bone pieces in late stage of the disease. The connective tissue obtained is seen as a cellular infiltrate and could not make out as synovial or ligamentous. The synovial membrane was also not satisfactorily detectable.

SIGNIFICANCE OF SACROILIAC JOINT INJECTION:

Intra-articular steroid injection is very effective in reducing the pain experienced by the patient. It is considered as a local treatment in spondyloarthropathy patients and is appropriate for the patients with low back pain and who are not responding to nonsteroidal anti-inflammatory drugs.

CONCLUSION:

Immune mediated mechanism plays a vital role in the pathogenesis of sacroilitis in spondyloarthropathies.

Dynamic magnetic resonance imaging is a valuable tool in quantifying the degree of inflammation and is very useful in detecting the very early and active sacroilitis.

Computed tomography is an effective method for sacroiliac joint biopsy. It is a safe technique and very useful in guiding the needle in to the sacroiliac joint. The ideal site for biopsy is between the middle and lower third of the sacroiliac joint.

Examination of sacroiliac biopsy specimens using CD markers offers a new strategy of treatment in the management of spondyloarthropathies by directing the monoclonal antibodies against that specific inflammatory cells.

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LIST OF ABBREVIATION

- MRI - Magnetic Resonance Imaging
- CT - Computed Tomography
- S1 - First Sacral Nerve
- S2 - Second Sacral Nerve
- HLA - Human Leukocyte Antigen
- AS - Ankylosing spondylitis
- SPA - Spondyloarthropathy
- CTL - Cytolytic T Lymphocyte
- ASAS - The Assesment of SpondyloArthritis

International Society

- IBP - Inflammatory Back Pain
- ESSG - European Spondyloarthropathy Study Group
- mNY - modified New York Criteria
- T1WI - T1 Weighted image
- STIR - Short Tau Inversion Recovery
- TNF - Tumor Necrosis Factor
- NSAID -Non Steroidal Anti-Inflammatory Drugs

- VAS - Visual Analog Scale
- FSE - Fast Spin Echo imaging

PROFORMA

STUDY TITLE:

**“COMPARITIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGINGWITH CT
GUIDED SACROILIAC BIOPSIESIN EARLY DIAGNOSIS OF SACROILITIS IN
SPONDYLOARTHROPATHIES”**

Sl.No:

Name :

Age/Sex :

Occupation :

Address :

Presenting Complaints and History:

Grading of pain by VAS:

HLA B27 positivity:

Criteria:

MRI GRADING

Activity Index:

Chronicity Index:

HPE FINDINGS

No. of Inflammatory Cells:

Type of Inflammatory cells:

Predominant Cell Type:

Predominant Tissue Type:

Signature of Investigator

Signature of the Participant

Witness:

INFORMED CONSENT FORM

Title of the study: "Comparative quantification study of dynamic MRI with CT guided sacroiliac biopsies in early diagnosis of sacroilitis in spondyloarthropathies -Histopathological correlation".

Name of the Participant: .

Name of the Principal (Co-Investigator): .

Name of the Institution: .

Name and address of the sponsor/agency(ies)(if any): _____
_____.

Documentation of the informed consent

I have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in “_____”(title of the study).

1. I have read and understood this consent form and the information provided to me.
2. I have had the consent document explained to me.
3. I have been explained about the nature of the study.

4. I have been explained about my rights and responsibilities by the investigator.
5. I have been informed the investigator of all the treatments I am taking or have taken in the past months including any native (alternative) treatment.
6. I have been advised about the risks associated with my participation in this study.*
7. I agree to cooperate with the investigator and I will inform him/her immediately if I suffer unusual symptoms. *
8. I have not participated in any research study within the past month(s).*
9. I have not donated blood within the past months—Add if the study involves extensive blood sampling. *
10. I am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my future treatment in this hospital. *
11. I am also aware that the investigator may terminate my participation in the study at anytime, for any reason, without my consent.*
12. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC. I understand that they are publicly presented.
13. I have understood that my identity will be kept confidential if my data are publicly presented
14. I have had my questions answered to my satisfaction.
15. I have decided to be in this research study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form I attest that the information given in this document has been clearly explained to me and understood by me, I will be given a copy of this consent document.

For adult participants:

Name and signature/ thumb impression of the participant (or legal representative if participant incompetent)

Name _____
Signature _____ Date _____

Name and Signature of impartial witness (required for illiterate patients):

Name _____
Signature _____ Date _____

Address and contact number of the impartial witness:

Name and Signature of the investigator or his representative obtaining consent:

Name _____ Date _____
Signature _____

PATIENT INFORMATION SHEET

Investigator (principal and at least one Co-investigator):DR.P.KARTHIK

Name of Participant:

Title:The role of dynamic MRI in early diagnosis of sacroilitis in spondyloarthropathies-Quantitative assessment by sacroiliac biopsies

You are invited to take part in this research/ study /procedures. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns.

You are being asked to participate in this study being conducted in Barnard Institute of Radiology,Madras Medical College,Chennai-3.

Spondyloarthropathy is the name for a family of inflammatory rheumatic diseases that cause arthritis.the most common is ankylosingspondylitis,which affects mainly the spine.others include reactive arthritis,psoriatic and enteropathic arthritis.

The main symptom in most patients is low back pain.many people with axial spondyloarthritis progresses to some degree of spinal fusion known as ankylosingspondylitis.nonsteroidal anti-inflammatory drugs offer symptom relief for most patients by reducing pain and swelling.

Sacroiliitis is a hallmark of ankylosing spondylitis and other seronegativespondyloarthropathies (SpA). Although radiography is a main method for the evaluation of this disorder,early diagnosis remains difficult;so that available therapies for the clinical treatment is scarce.

So we want to find an effective means of modality for early accurate diagnosis of sacroilitis so that appropriate treatment can be initiated for the best outcome of the disease.

Sacroiliac joints are at the lowest part of the spine,where sacral spine segments connect with the pelvic bones flanking the sacrum.

Study Procedures

First you will be subjected to 3-Tesla magnetic resonance imaging in which your sacroiliac joint will be imaged. Then you will be given intravenous injection of gadolinium contrast agent followed by acquisition of images. The whole procedure takes one hour.

After that you will be taken to interventional suite where you will be asked to wear a gown with the selected area of spine exposed. Procedures are carried with you lying face down in a CT scanner. We will ensure that you are comfortable as possible.

A series of planning images are performed, with the area to be biopsied planned on the computer terminal and then marked on your skin. The radiologist will then clean your skin with an antiseptic wash and inject local anaesthetic into the biopsy site. This results in stinging sensation which is temporary until the skin becomes numb, usually taking 10-30 seconds.

A fine needle is then passed through the skin and tissues, constantly manipulated under CT guidance until it enters the sacroiliac joint. Biopsy taken by rotating the needle clockwise after entering into the joint. 1mm of tissues (including bones and soft tissues) will be biopsied. After the procedure a mixture of cortisone and local anaesthetic are injected into the joint. Some discomfort will be felt for a short time whilst the injection distends the joint. The local anaesthetic will then numb the joint. The specimen obtained is sent for histopathological examination.

As the local anaesthetic has been injected into the spine most patients will be pain free. Patients are able to walk freely after the procedure. You should not drive for the rest of the day. The following day you may return to work and gradually increase the activities.

You may have to come to the hospital (study site) for examination and investigations apart from your scheduled visits, if required.

Women of Childbearing Potential

You must not participate if you are pregnant, breast feeding a child, or if you are of child bearing potential and not practicing two forms of effective methods of contraception.

Possible Risks to you

Risks of this procedure is rare and includes

Infections:most of these are minor(1-2%),however can be serious requiring hospital admission,intravenous antibiotics and surgery.

Bleeding:this is also rare and common in patients with bleeding disorders.

Nerve damage:from direct needle trauma.

Possible benefits to other people

The result of the research may provide benefits to the society in terms of advancement of medical knowledge and/or therapeutic benefits to future patients

Confidentiality of the information obtained from you

You have the right to confidentiality regarding the privacy of your medical information (personal details, results of physical examinations, investigations, and your medical history). By signing this document, you will be allowing the research team investigators, other study personnel, sponsors, IEC and any person or agency required by law like the Drug Controller General of India to view your data, if required.

The information from this study, if published in scientific journals or presented at scientific meetings, will not reveal your identity.

How will your decision to not participate in the study affect you?

Your decisions to not participate in this research study will not affect your medical care or your relationship with investigator or the institution. Your doctor will still take care of you and you will not loose any benefits to which you are entitled.

Can you decide to stop participating in the study once you start?

The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during course of the study without giving any reasons.

However, it advisable that you talk to the research team prior to stopping the treatment.

MASTER CHART

Sl. NO	NAME	AGE	SEX	DD	VAS	CRITERIA	MRI FINDINGS		CELLS/MM2	INFLAMMATORY CELLS				PREDOMINANT CELL TYPE	PREDOMINANT TISSUE	HLA B27 +VITY
							ACTIVITY INDEX	CHRONICITY INDEX		T CELLS	MAC	B CELLS	NEU			
1	RAVI	36	M	2.5	7	AS	B	I	18	8	6	3	1	T CELLS	PCT	+VE
2	ALPHONS	31	M	6	6	uSPA	A	II	10	2	8	0	0	MAC	CALC	+VE
3	MARY	28	F	1.5	6	AS	B	I	-	-	-	-	-	-	-	-VE
4	NATESAN	51	M	10	6	uSPA	A	II	6	1	5	0	0	MAC	OSSIF	+VE
5	SATHYA	45	F	8	8	AS	A	II	8	2	6	0	0	MAC	CART	+VE
6	DEVARAJ	32	M	1	7	AS	B	I	-	-	-	-	-	-	-	+VE
7	MARIAMMAL	35	F	3.2	9	uSPA	B	I	23	11	8	2	2	T CELLS	NVF	+VE
8	THANGA PANDIAN	35	M	5.5	5	AS	A	I	8	2	6	0	0	MAC	CAL	+VE
9	SIVARAJ	18	M	2.2	7	AS	B	I	18	9	6	2	1	T CELLS	PCT	+VE
10	TAMILVANAN	22	M	1.5	7	PsA	B	I	15	6	4	3	2	T CELLS	NVF	+VE
11	VIMALAN	24	M	7.5	7	AS	A	II	8	2	6	0	0	MAC	OSSIF	+VE
12	RAMASAMY	20	M	12	8	uSPA	A	II	6	1	5	0	0	MAC	OSSIF	-VE
13	LENIN	46	M	1.5	8	AS	B	I	20	8	6	4	2	T CELLS	PCT	+VE
14	KARTHIK	38	M	1.8	8	AS	B	I	12	5	4	2	1	T CELLS	NVF	+VE
15	ANANDHAN	32	M	2.3	5	PsA	A	I	8	1	7	0	0	MAC	CAL	+VE
16	LOGANATHAN	48	M	6.2	6	AS	A	II	12	4	8	0	0	MAC	CAL	+VE
17	MANIKKAM	16	M	10	5	AS	A	II	-	-	-	-	-	-	-	+VE
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19	LAKSHMI	46	F	5	7	PsA	B	I	18	8	6	2	2	T CELLS	PCT	-VE
20	DIVYA	43	F	4.2	5	AS	B	I	16	8	4	4	0	T CELLS	NVF	+VE
21	VEERASAMY	37	M	7	5	uSPA	A	II	-	-	-	-	-	-	-	+VE
22	VARADHARAJ	44	M	2.2	8	AS	B	I	22	10	8	1	3	T CELLS	NVF	+VE
23	VIMALA	22	F	10.2	7	uSPA	A	II	6	2	4	0	0	MAC	OSSIF	+VE
24	KANAGASABAI	20	M	7.4	7	AS	A	II	11	4	7	0	0	MAC	CAL	-VE
25	SILAMBAN	38	M	6.2	7	AS	A	II	8	2	6	0	0	MAC	OSSIF	+VE
26	VIJAYANAND	24	M	1.6	9	uSPA	B	I	21	12	6	2	1	T CELLS	NVF	+VE
27	HARI	32	M	4	9	uSPA	B	I	12	6	3	2	1	T CELLS	NVF	+VE
28	MURUGAN	29	M	5.2	5	AS	A	II	9	2	7	0	0	MAC	CAL	+VE
29	LATHA	40	F	5.5	7	AS	A	II	10	2	8	0	0	MAC	CAL	+VE
30	PRABHAKARAN	25	M	7.2	9	uSPA	A	II	8	1	7	0	0	MAC	OSSIF	-VE
31	PRIYA	34	F	3.2	8	PsA	B	I	18	10	5	1	2	T CELLS	PCT	+VE
32	PAVAN KUMAR	27	M	0.8	8	AS	B	I	21	10	9	1	1	T CELLS	NVF	+VE
33	SENTHIL	45	M	5.8	8	uSPA	A	II	12	6	3	2	1	MAC	CAL	+VE
34	PREMA	32	F	8.1	6	AS	A	II	8	2	5	1	0	MAC	OSSIF	-VE
35	PRABHU	26	M	1.2	6	uSPA	B	I	20	9	8	1	2	T CELLS	NVF	-VE

ABBREVIATIONS

DD – DISEASE DURATION	AS-ANKYLOSING SPONDYLITIS	NEU-NEUTROPHILS	OSSIF-OSSIFICATION
VAS- VISUAL ANALOG SCORING	PsA-PSORIATIC ARTHRITIS	PCT-PROLIFERATING CONNECTIVE TISSUE	
M-MALE	uSPA-UNDIFFERENTIATED SPONDYLOARTHROPATHY	NVF-NEW VESSEL FORMATION	
F-FEMALE	MAC-MACROPHAGES	CAL-CALCIFICATION	

**INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003**

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To

Dr.Karthik.P
Post Graduate in Radio Diagnosis
Madras Medical College
Chennai 600 003

Dear Dr.Karthik.P,

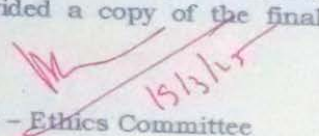
The Institutional Ethics Committee has considered your request and approved your study titled **"COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY DIAGNOSIS OF SACROILITIS IN SPONDYLOARTHROPATHIES "** NO.21032015.

The following members of Ethics Committee were present in the meeting hold on 03.03.2015 conducted at Madras Medical College, Chennai 3

- | | |
|---|----------------------|
| 1. Prof.C.Rajendran, MD | :Chairperson |
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| 6. Prof.Saraswathy,MD.,Director,Pathology, MMC | : Member |
| 7. Prof.S.G.Sivachidambaram,MD.,Director I/c
Inst.of Internal Medicine,MMC | : Member |
| 8. Thiru S.Rameshkumar, B.Com., MBA. | : Lay Person |
| 9. Thiru S.Govindasamy, BA., BL., | : Lawyer |
| 10.Tmt.Arnold Saulina, MA., MSW., | : Social Scientist |

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.


Member Secretary - Ethics Committee

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INTRODUCTION:

Spondyloarthropathies refers to a group of connective tissue disorders having similar characteristics with involvement of axial and peripheral joints.

Sacroilitis is an important manifestation, which is centrally involved joint in ankylosing spondylitis and other seronegative spondyloarthropathies.

Sacroiliac joints are one of the earliest joints to be involved and sacroilitis is one of the important feature for diagnosing these spondyloarthropathies. Although Xray remains the initial method for evaluation of these disorders, early diagnosis of this disease remains difficult.

Biopsy is needed to confirm the presence of sacroilitis in spondyloarthropathy cases. Sacroiliac joint biopsy is not a versatile procedure to be carried out in every case of spondyloarthropathy as the sacroiliac joints are deeply located and the joint is not amenable for biopsy. The purpose of this study is to delineate the role of 'dynamic Magnetic Resonance Imaging' in early diagnosis of sacroilitis

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COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY DIAGNOSIS OF SACROILIITIS IN SPONDYLOARTHRITIDES

INTRODUCTION:

Spondyloarthropathies refer to a group of connective tissue disorders having
similar characteristics with involvement of axial and peripheral joints.

Sacroiliitis is an important manifestation, which is centrally involved joint in
early being spondyloitis and other seronegative spondyloarthropathies.

Sacroiliac joints are one of the earliest joints to be involved and sacroiliitis is one
of the important features for diagnosing these spondyloarthropathies. Although
X-ray remains the initial method for evaluation of these disorders, early
diagnosis of this disease remains difficult.

Diopsy is needed to confirm the presence of sacroiliitis in spondyloarthropathy
cases. Sacroiliac joint biopsy is not a routine procedure to be carried out in
every case of spondyloarthropathy as the sacroiliac joints are deeply located and
the joint is not amenable for biopsy. The purpose of this study is to delineate the
role of 'dynamic Magnetic Resonance Imaging' in early diagnosis of sacroiliitis
thereby avoiding the biopsy of sacroiliac joint.

**“COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC
MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN
THE EARLY DIAGNOSIS OF SACROILITIS IN
SPONDYLOARTHROPATHIES”**

Dissertation submitted to

**THE TAMILNADU Dr.M.G.R. MEDICAL
UNIVERSITY**

*In partial fulfillment of the requirements
of*

**M.D. DEGREE EXAMINATION
BRANCH – VIII– RADIODIAGNOSIS**

**MADRAS MEDICAL COLLEGE
&
RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL
CHENNAI– 600 003**



**THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI – TAMILNADU, INDIA
APRIL 2016**

CERTIFICATE

This is to certify that the dissertation “**COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY DIAGNOSIS OF SACROILITIS IN SPONDYLO ARTHROPATHIES**” titled submitted by **Dr.P.KARTHIK** appearing for **M.D (Radiodiagnosis)** degree examination in April 2016 is a bonafide record of work done by her under my guidance and supervision in partial fulfillment of requirement of the TamilNadu Dr. M.G.R Medical University, Chennai. I forward this to the TamilNadu Dr. M.G.R Medical University, Chennai.

Dr.D.RAMESH , M.D.,
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Madras Medical College,
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Chennai – 600 003.

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Hospital, Chennai - 600 003.

Dr. VIMALA M.D
Dean,
Madras medical college,
Rajiv Gandhi Government General
Hospital, Chennai - 600 003.

DECLARATION

I **Dr.P.KARTHIK**, solemnly declare that this dissertation titled **“COMPARATIVE QUANTIFICATION STUDY OF DYNAMIC MR IMAGING WITH CT GUIDED SACROILIAC BIOPSIES IN THE EARLY DIAGNOSIS OF SACROILITIS IN SPONDYLOARTHROPATHIES”** is a bonafide work done by me at the Barnard Institute of Radiology, Madras Medical College and Government General Hospital, under the supervision of the Dr.D.Ramesh, M.D., Professor, Barnard Institute of Radiology, Madras Medical College and Rajiv Gandhi Government General Hospital. This dissertation is submitted to The Tamil Nadu Dr. M.G.R Medical University, towards partial fulfillment of requirement for the award of M.D. Degree Radiodiagnosis.

Place: Chennai

Date: 30.9.2015

Dr.P.Karthik

ACKNOWLEDGEMENT

I express my heartfelt gratitude to the Dean, **Dr.R.VIMALA, M.D.**, Madras Medical College & Rajiv Gandhi Govt. General Hospital, Chennai-3 for permitting me to do this study.

I express my gratitude to **Prof. N.KAILASANATHAN, M.D., D.M.R.D.**, Head of the Department, Barnard Institute of Radiology, for his valuable guidance in doing the dissertation work.

I owe a lot to my guide, **Dr.D.RAMESH, M.D.**, whose expert guidance constant encouragement created an interest for me to pursue this study on advanced MRI imaging. It is his constant supervision and support, that made me possible to finish this study without much difficulty.

I am extremely thankful to my Professors, **Dr.K.MALATHY, M.D.,D.M.R.D**, **Dr.S.KALPANA, M.D.,D.N.B.**, **Dr.S.BABU PETER, M.D., DNB**, **Prof. A.P.ANNADURAI, M.D., D.M.R.D.**,and Assistant professors **Dr.J.CHEZHIAN,M.D.**, **Dr.K.GEETHA, M.D.**, **Dr.S.ANBUMALAR, M.D., D.N.B, FRCR** **Dr.SARANYA, D.M.R.D**, and **Dr. M.P.BALAN, D.M.R.D**, in the Barnard Institute of Radiology for their constant support, encouragement and advice during my study.

I also thank **my past and present fellow postgraduates** who helped me in carrying out my work and preparing this dissertation.

I thank **all Radiology technicians, Staff Nurses and all the Paramedical staff members** in Barnard Institute of Radiology, for their co- operation in conducting the study.

I thank my family members for their understanding and co-operation in completion of this work.

Last but not the least; I owe my sincere gratitude to the patients and their relatives who co-operated for this study, without whom the study could not have been possible.

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